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JAN 77 J C WOLFF, R S POTTER, P C ALLING N00600-76-C-0508
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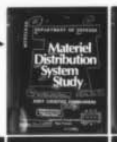

DEPARTMENT OF DEFENSE

Materiel Distribution System Study

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26 Jan 77

JOINT LOGISTICS COMMANDERS

180p.

Commercial Transportation
Rate Forecast

MDA903-76-C-0598

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FOREWORD

The Department of Defense Materiel Distribution System (DODMDS) Study was chartered by the Joint Logistics Commanders to "conduct an examination of the current DOD Materiel Distribution System and recommend improvements which will support the Services' requirements effectively and economically in peace and under mobilization requirements".

This DODMDS Study Commercial Transportation Rate Forecast will be an appendix to the transportation rate methodology description contained in Chapter 3 of the Study Final Report. The forecast, based on data available in early 1976, concerns future U.S. commercial transportation costs and capabilities. It includes both quantitative and qualitative factors. Specific forecasted rate changes are provided for carload, truckload, less-than-truckload, domestic air and international air modes. Forecasted sealift rates were provided separately by the Military Sealift Command, port handling rates by the Military Traffic Management Command and military airlift rates by the Military Airlift Command. The forecasted rate changes will be used as appropriate to modify weighted average transportation rate inputs to DODMDS study computer models. Additionally, the forecast is structured to allow adjustment to individual cost elements (i.e., fuel, labor, etc.) to conduct sensitivity analyses.

A separate review of the qualitative factors pertaining to ocean transportation, to augment the sealift rate forecast provided by the Military Sealift Command, will also be an appendix to Chapter 3 of the Study Final Report.

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This forecast was prepared under Contract N00600-76-C-0508, by Drake Sheahan/Stewart Dougall, Inc., marketing and physical distribution consultants, 330 Madison Avenue, New York, New York 10017. Contractor personnel responsible for its preparation were Mr Joel C. Wolff, Director; Mr Ronald S. Potter, Vice President; and Associates Mr Philip C. Alling and Mr Richard W. LaPointe.

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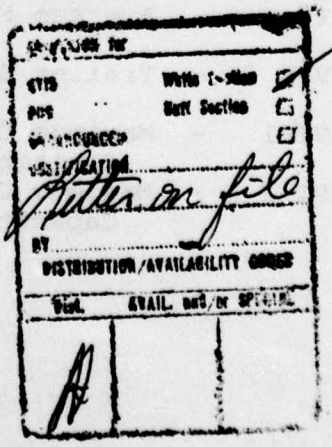


FIGURES

EXHIBITS

HIGHLIGHTS

1. Freight Rate Increases

- Between 1976 and 1982 motor TL rates will increase the least and international air cargo, the most. The following average annual rate of freight rate increases is predicted:

Motor	•	Truckload	+2.7%
	•	Less than truckload	+5.0%
Rail	•	Carload	+5.2%
Air	•	Domestic	+8.3%
	•	International	+8.5%

2. Relative Size of Modes

- Railroads carry 6 times as much tonnage as trucks. Trucks carry about 500 times as much as domestic air. This same general relationship is expected to continue through 1982. The expected relationship is as follows:

	Revenue tons			
	1976		1982	
Rail	1.5	Billion	1.6	Billion
Motor	248	Million	286	Million
Air				
• Domestic	405	Thousand	394	Thousand
• International	715	Thousand	726	Thousand

3. Operating Revenues

- Although railroads carry far more tonnage than truck and air, their operating profit per ton is only about $1 compared with $2.45 for trucks and $55.24 for international air. With rate increases and higher earnings on investment expected by 1982, railroads are projected to obtain $1.75 per-ton operating profit, $3.25 for truckers and $90.22 for international air. We predict no operating profits for domestic all-cargo operations.

  The volume carried by the railroads, however, even at lower per-ton profits, is expected to produce far greater total net operating revenues than truck and air. These may be summarized as follows:

	Net operating revenue (dollars)	
	1976	1982
Rail	1.5 Billion	2.8 Billion
Motor	609 Million	932 Million
Air		
• Domestic	0 Million	0 Million
• International	39 Million	65 Million

4. Relative Importance of Cost Elements

- Labor comprises the greatest cost for each mode -- over 50% for rail and motor and about 40% for air. As a percentage of the total, rail is expected to decrease (from 54% to 50%); but motor and air increase slightly (motor from 58% to 59%, and air from 38% to 41% internationally, but only 41% to 42% domestically).

- Fuel is about 24% of airline total costs but only about 9% for rail and 10% for trucks. The air proportion is expected to be going up to about 26%, rails up to 11%, and motor up to 12%.

5. Investment Factors

- Transportation has been losing ground to other industries in its competition for capital because of relatively low earnings. This will probably improve a little but not much.

6. Management Trends

- The general trend is to fewer, larger carriers.

7. National Policies Affecting Transportation

- With the reduction of military tonnage and general improvement in the economy, defense policies are likely to have a diminishing influence on commercial transportation. Environmental policies are introducing delays in facilities and increased costs of operation. Energy policies have tended to stabilize the supply and the prices so that they are more predictable.

8. Transportation Policies

- Federal policies to promote transportation are now in a more even-handed era with the recent railroad programs tending to offset some of the highway and aviation capital improvement financing programs. User charges will continue on highway and airway users; waterway user charges, eminent domain for slurry pipelines and improvements in locks and dams on the Mississippi River are still under congressional consideration. Imposition of charges on waterway users would favor railroads. Granting slurry pipelines eminent domain would be adverse to rail interests as would Mississippi River improvements.

- Safety, environmental, and energy regulations are not likely to have a major impact but will add costs to all modes. This may be offset to some extent by some relaxation of economic regulatory controls on rail, trucks, and air modes. Large changes are not expected, however.

9. Technological Developments

- Only incremental evolutionary changes are expected in vehicles and power plants to 1982 because of a variety of constraints -- capital needs, environmental, energy and support services.

- The operational and support services improvements which are anticipated will improve efficiency primarily through applications of automatic data processing.

FORECAST OF COMMERCIAL TRANSPORTATION RATES AND DEVELOPMENTS

EXECUTIVE SUMMARY

A. Introduction

Transportation costs are one of the major factors in the review and analysis of the Defense Materiel Distribution System now under consideration by the DOD Materiel Distribution System (DODMDS) Study Group of the Joint Logistics Commanders. The purpose of this Report is to provide a forecast of the magnitude of the rate increases that can be anticipated to the year 1982 for the rail, truck, and air transportation modes. These figures will be used as inputs to the computer models being developed to analyze the depot and transportation costs under the present distribution system, under an improved system, and under a system reflecting future technological change.

The forecast is based primarily upon the historical cost data, by mode, for each of the principal cost elements -- labor, fuel, materials and supplies, depreciation and taxes. These data were projected and modified to reflect future economic and management trends, national policies affecting transportation (including environmental and energy), governmental transportation policies, and technological developments.

B. Freight Rate Increases

Projected freight rate average annual increases will range from 2.7% to 8.5% over the next five years among the commercial transportation modes. The smallest expected increases are in motor carrier rates, while the largest increases are forecast for international air rates. Major reasons for the modal variations are different rates of increase in operating costs, volume of business, and productivity.

More specifically, the average annual motor carrier truckload (TL) rate of increase of 2.7% is about half the increase expected in motor carrier less-than-truckload (LTL) rates - 5% - and railcar-load (CL) rates of 5.2%. The greatest average annual increases will be in air freight - domestic air 8.3%, and international air 8.5%, as shown in Figure 1.

On a cumulative basis over the five-year period 1977-1982, motor carrier truckload rates are expected to increase 17.3%; motor carrier less-than-truckload 34%; railcar-load 35.1%; domestic air 60.7%; and international air 63.1% as shown in Figure 2.

Figure 1

Forecast Average Annual Rate
Of Freight Rate Increases

(1977-1982)

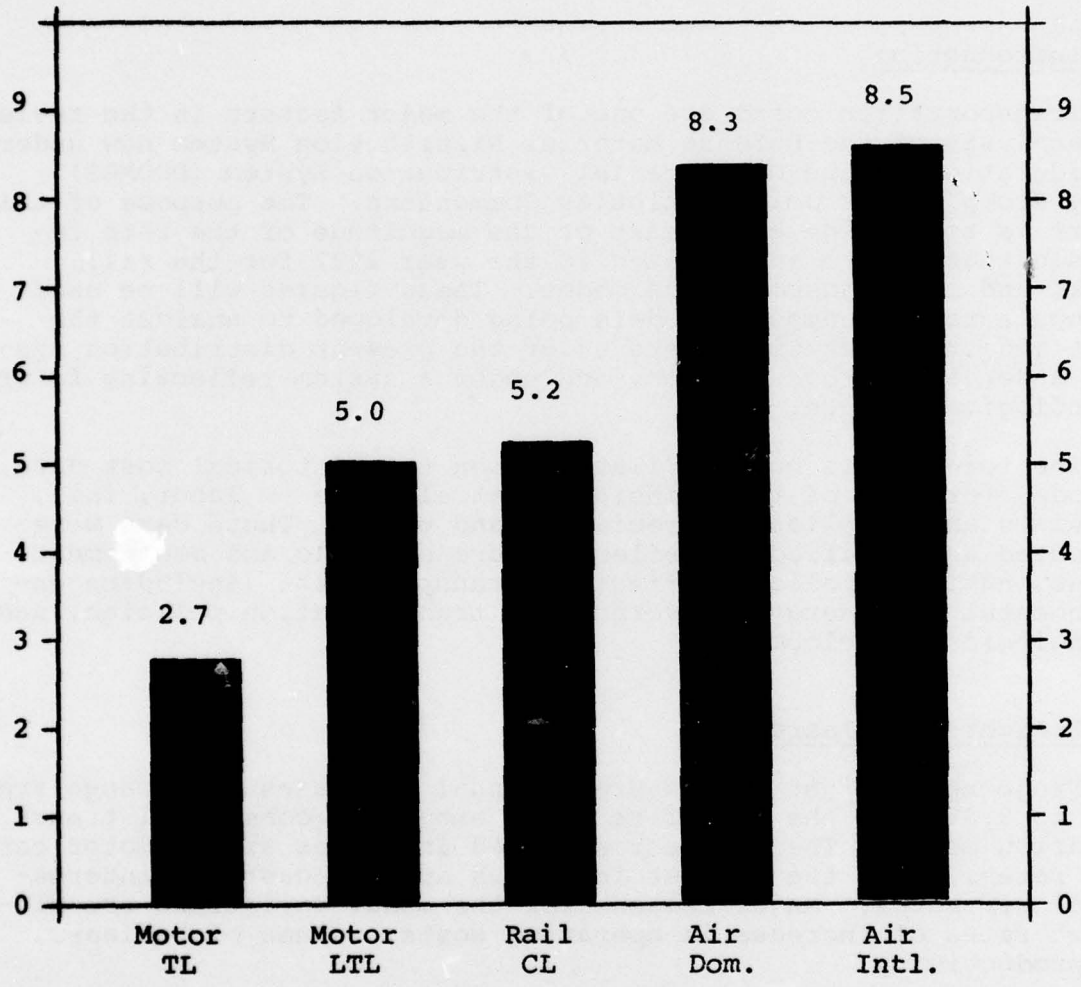
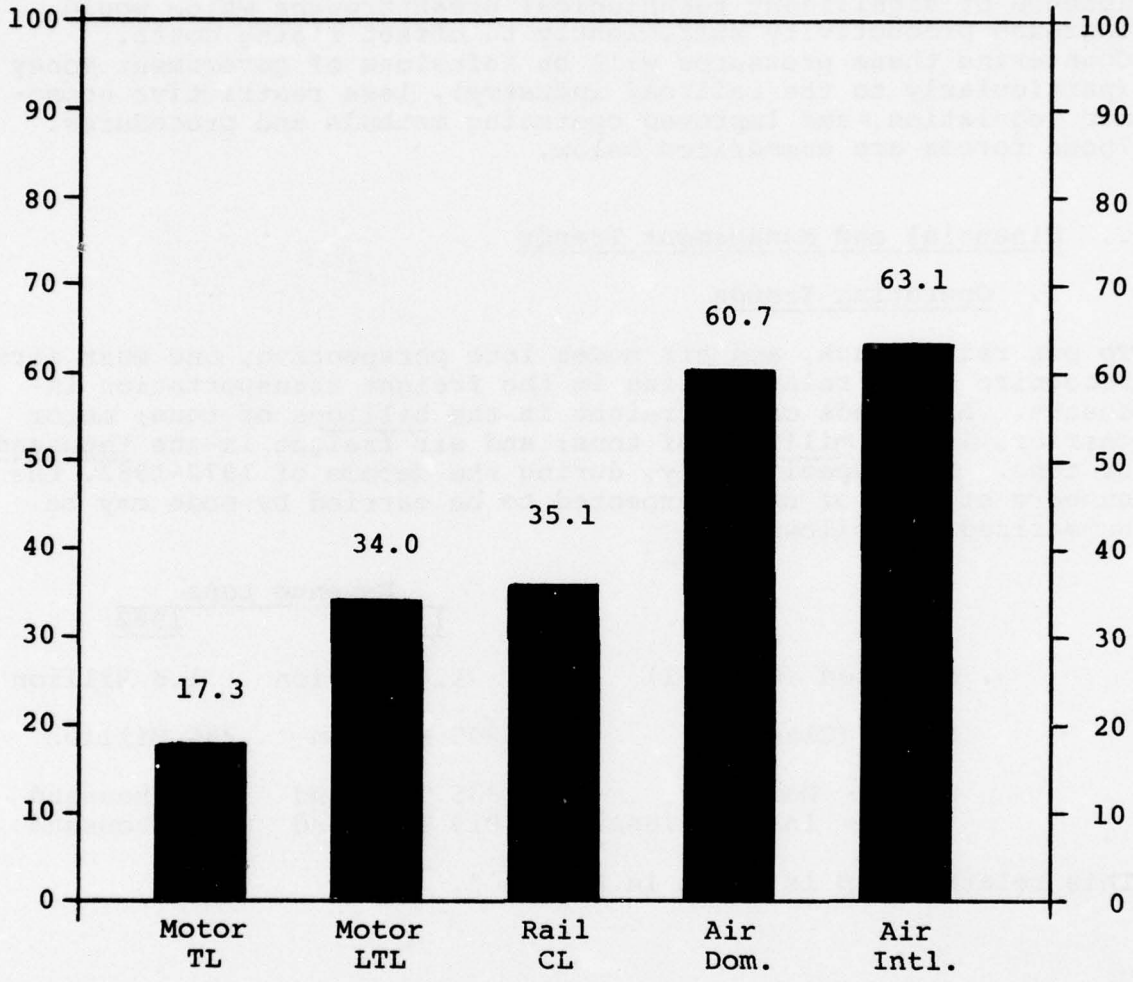


Figure 2

Cumulative Percentage Increase
Of Freight Rate Increases

(1977-1982)



The most potent forces prompting higher freight rates are national economic conditions accentuated in the transportation industries by higher labor and fuel costs. Other factors favoring increases are the need for higher return on investment to attract capital, added safety and environmental costs, and the absence of significant technlogical breakthroughs which would increase productivity sufficiently to offset rising costs. Countering these pressures will be infusions of government money (particularly to the railroad industry), less restrictive economic regulation, and improved operating methods and procedures. These forces are summarized below.

C. Financial and Management Trends

1. Operating Trends

To put rail, truck, and air modes into perspective, one must first recognize their relative size in the freight transportation industry. Railroads carry freight in the billions of tons; motor carriers in the millions of tons; and air freight in the thousands of tons. More specifically, during the decade of 1972-1982, the numbers of tons of cargo expected to be carried by mode may be summarized as follows:

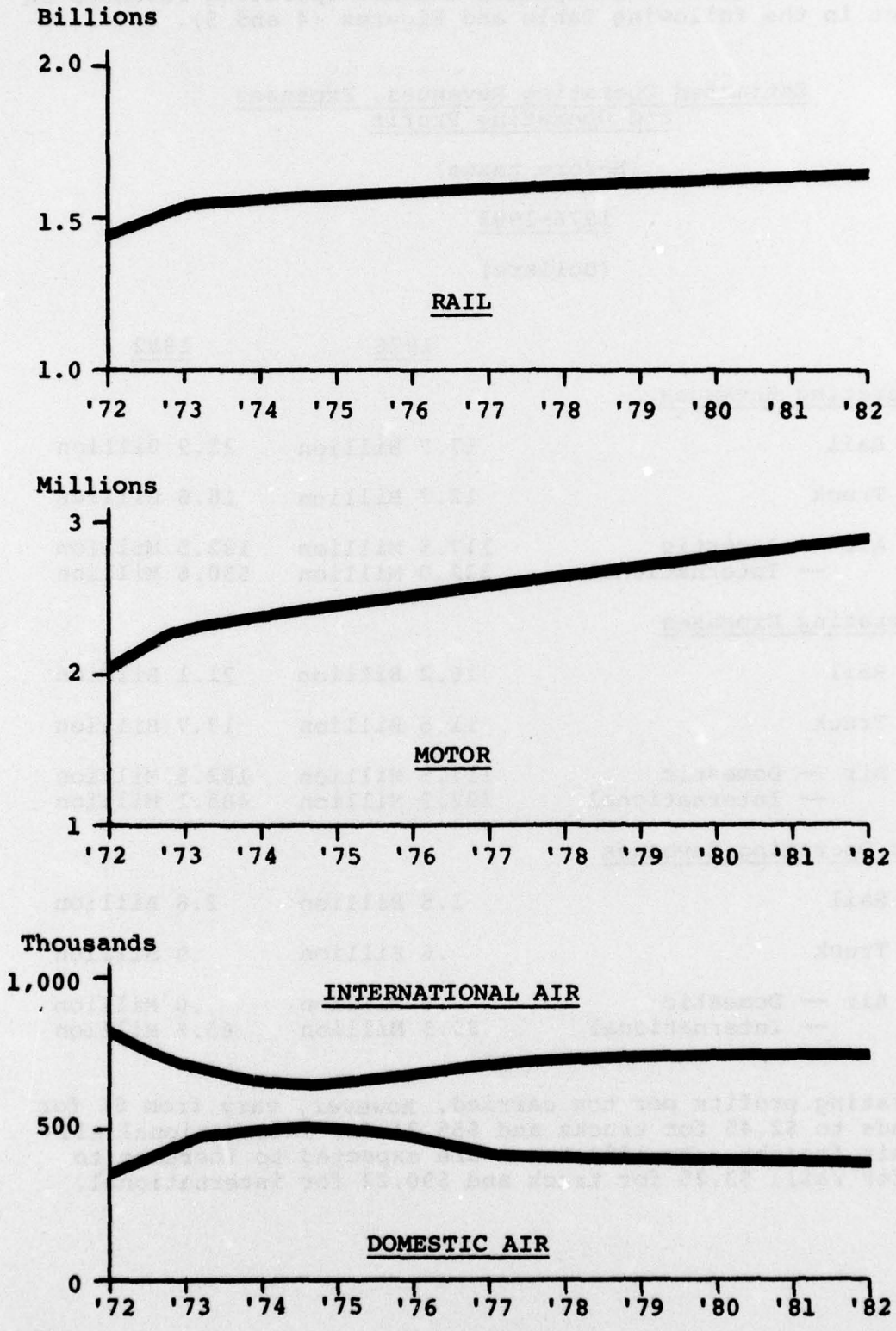
	Revenue tons	
	1972	1982
Railroad (Class I)	1.4 Billion	1.6 Billion
Motor (Class I)	205 Million	286 Million
Air — Domestic	335 Thousand	394 Thousand
— International	819 Thousand	726 Thousand

This relationship is shown in Figure 3.

Figure 3

Revenue Tons Originated

(1972-1982)



The relative size of each mode and the trends in terms of operating revenues, operating expenses and net operating revenues is apparent in the following Table and Figures (4 and 5).

Estimated Operating Revenues, Expenses and Operating Profit

(Before taxes)

1976-1982

(Dollars)

	1976	1982
Operating Revenues		
Rail	17.7 Billion	23.9 Billion
Truck	12.2 Billion	18.6 Billion
Air — Domestic	117.5 Million	182.5 Million
— International	332.0 Million	550.6 Million
Operating Expenses		
Rail	16.2 Billion	21.1 Billion
Truck	11.6 Billion	17.7 Billion
Air — Domestic	117.5 Million	182.5 Million
— International	292.5 Million	485.1 Million
Net Operating Revenues		
Rail	1.5 Billion	2.8 Billion
Truck	.6 Billion	.9 Billion
Air — Domestic	.0 Million	.0 Million
— International	39.5 Million	65.5 Million

Operating profits per ton carried, however, vary from $1 for railroads to $2.45 for trucks and $55.24 for international all-cargo air freight. By 1982 these are expected to increase to $1.75 for rail, $3.25 for truck and $90.22 for international.

Figure 4

Revenues, Expenses and Net Operating Revenues

(Rail and truck)

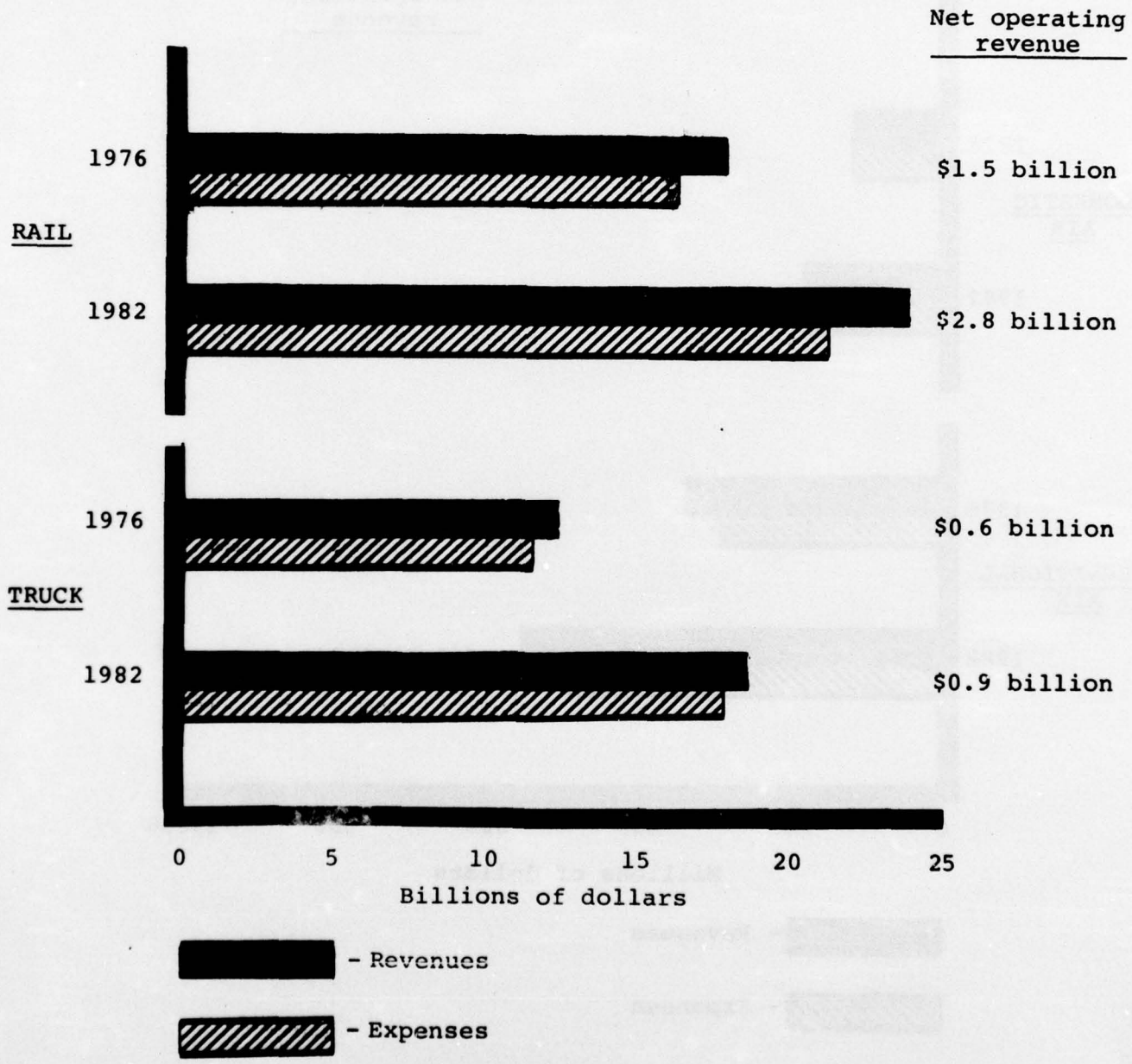
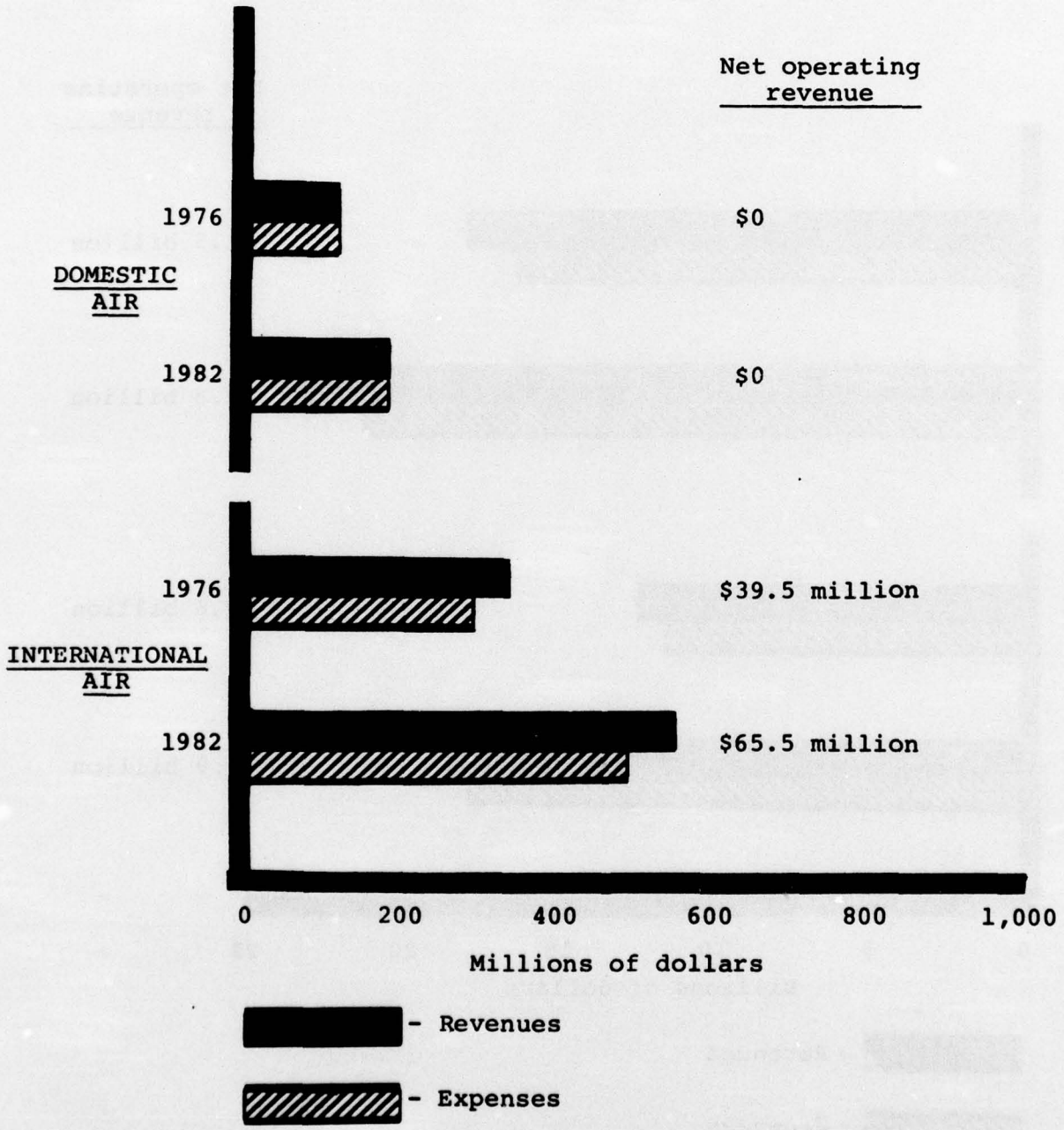


Figure 5

Revenues, Expenses and Net Operating Revenues

(Air)



2. Costs

To establish the basis for forecasting rate increases, the individual cost elements were examined. In general, labor constitutes the single largest item of cost for all modes, with motor and rail being the most labor intensive -- labor cost alone accounting for over 50% of total operating costs for these modes. Fuel costs are a considerably higher proportion of aviation costs than for the surface modes. Other costs, including depreciation, materials and supplies, and miscellaneous expenses, make up about one third of the total cost for each mode. The relative proportions of the principal cost elements for the various modes, together with a comparison of the expected changes in their relative importance between 1976 and 1982, are shown in Figure 6.

The relative costs of labor and fuel can best be understood in terms of "Cents Per Ton-mile Costs" for each, with comparisons and trends between and among the modes. These relationships are shown on Figures 7 and 8. Total per ton-mile cost trends for each mode are illustrated in Figure 9.

Additional insights regarding individual expense items follow in the subsequent paragraphs.

a. Labor costs. Labor costs represent the largest operating costs for all modes and, with the exception of the recent fuel costs, have been increasing at a faster rate than any other operting cost category. The largest rate of increase in labor costs is projected for the international all-cargo airline industry, reflecting the relatively high cost per employee in this industry. The railroad industry is the only mode expected to experience a decrease in labor operating costs as a percent of total costs as the number of employees continues to decline.

b. Fuel costs. All modes have experienced at least a 100 percent increase in fuel costs since 1973. The airline industry was most affected by these increases. Their fuel costs now constitute over 20 percent of operating costs. Rail fuel costs increased from 4 percent to 9 percent of total operating costs; and motor carrier fuel costs increased from 4 percent to over 10 percent during this time. Future increases in crude oil prices are projected to range from 6 to 7 percent per year, barring any unexpected developments.

c. Other costs.

Materials and supplies costs. The railroad industry is experiencing significant costs associated with maintaining its privately owned right-of-way. (Trucks, airplanes, and ships operate on publicly owned rights-of-way.) Large increases in materials

Figure 6

Composition of Carrier Operating Costs -- 1976 and 1982

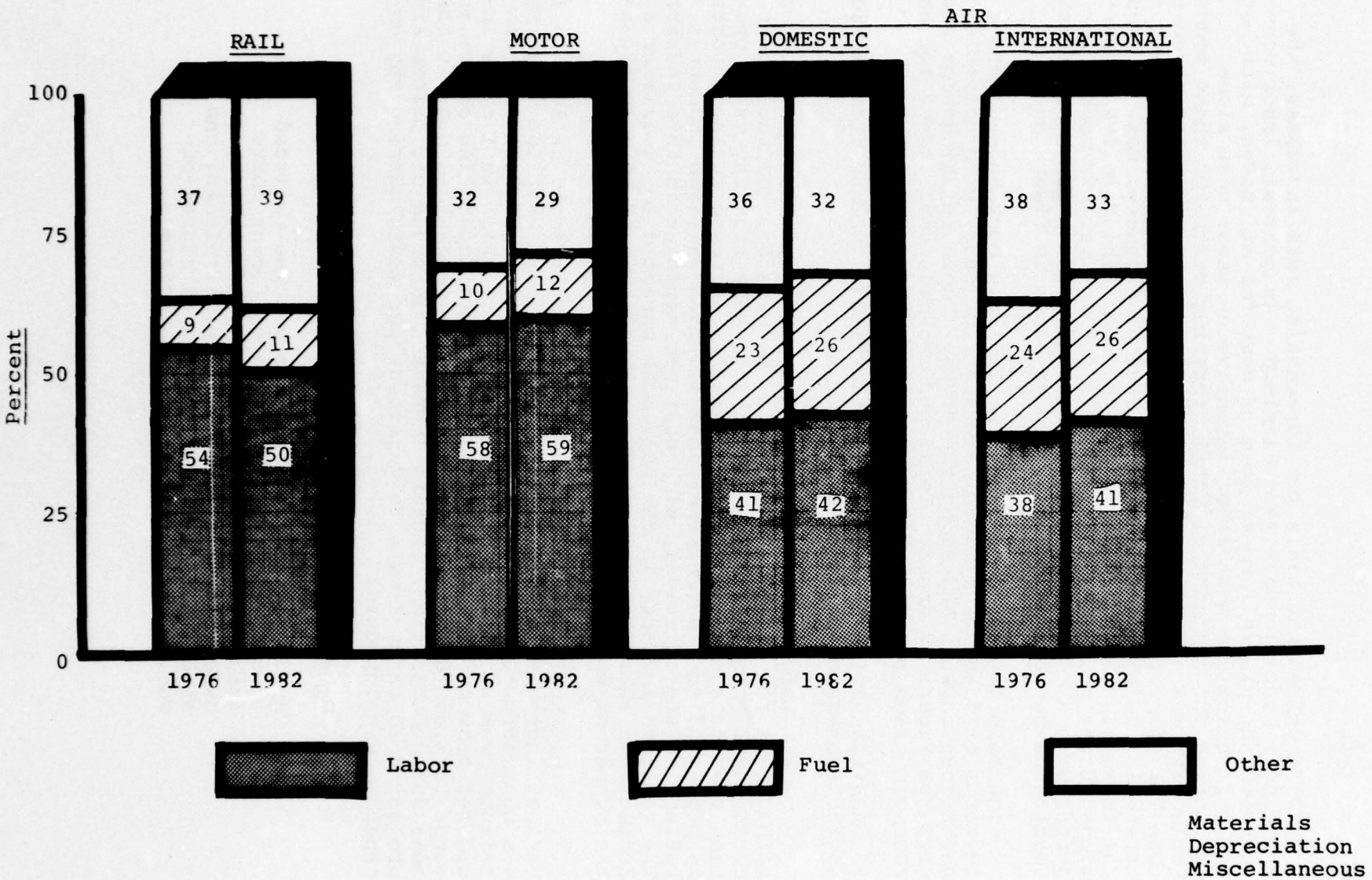


Figure 7

Labor Costs -- Cents per Ton-mile

(1967-1982)

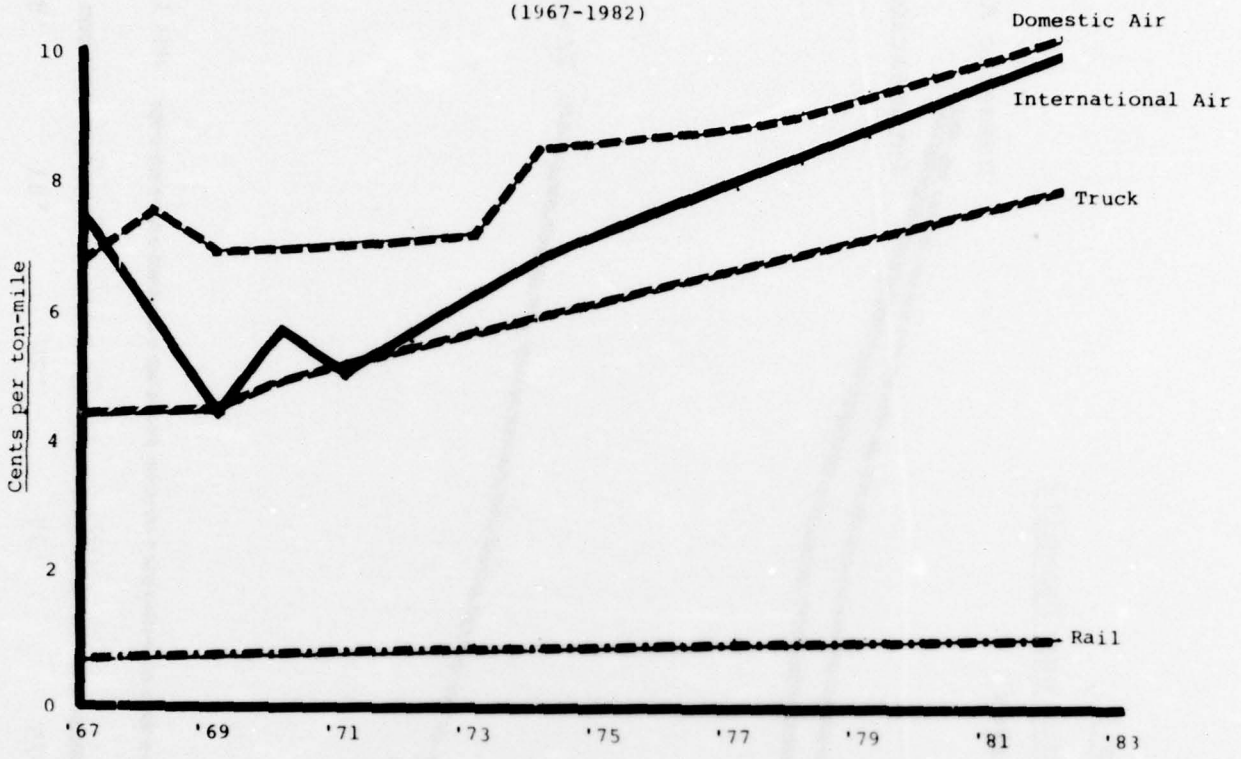


Figure 8

Fuel Costs -- Cents per Ton-mile

(1967-1982)

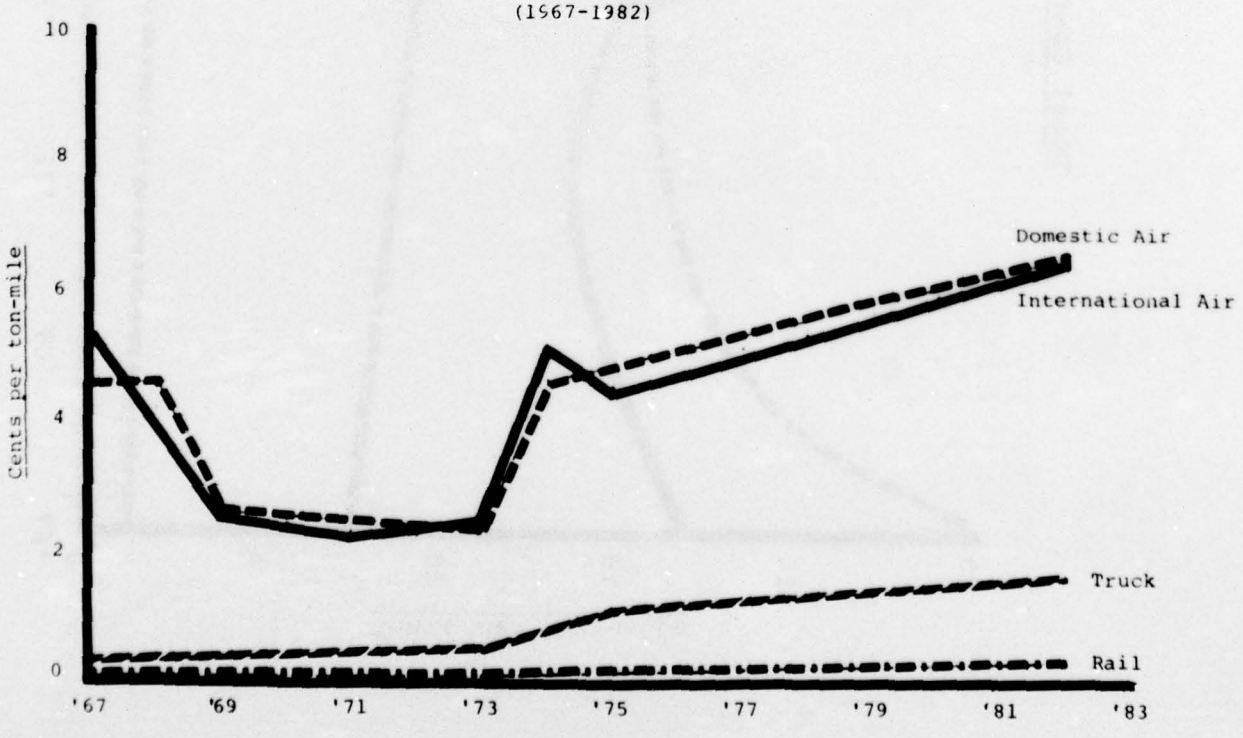
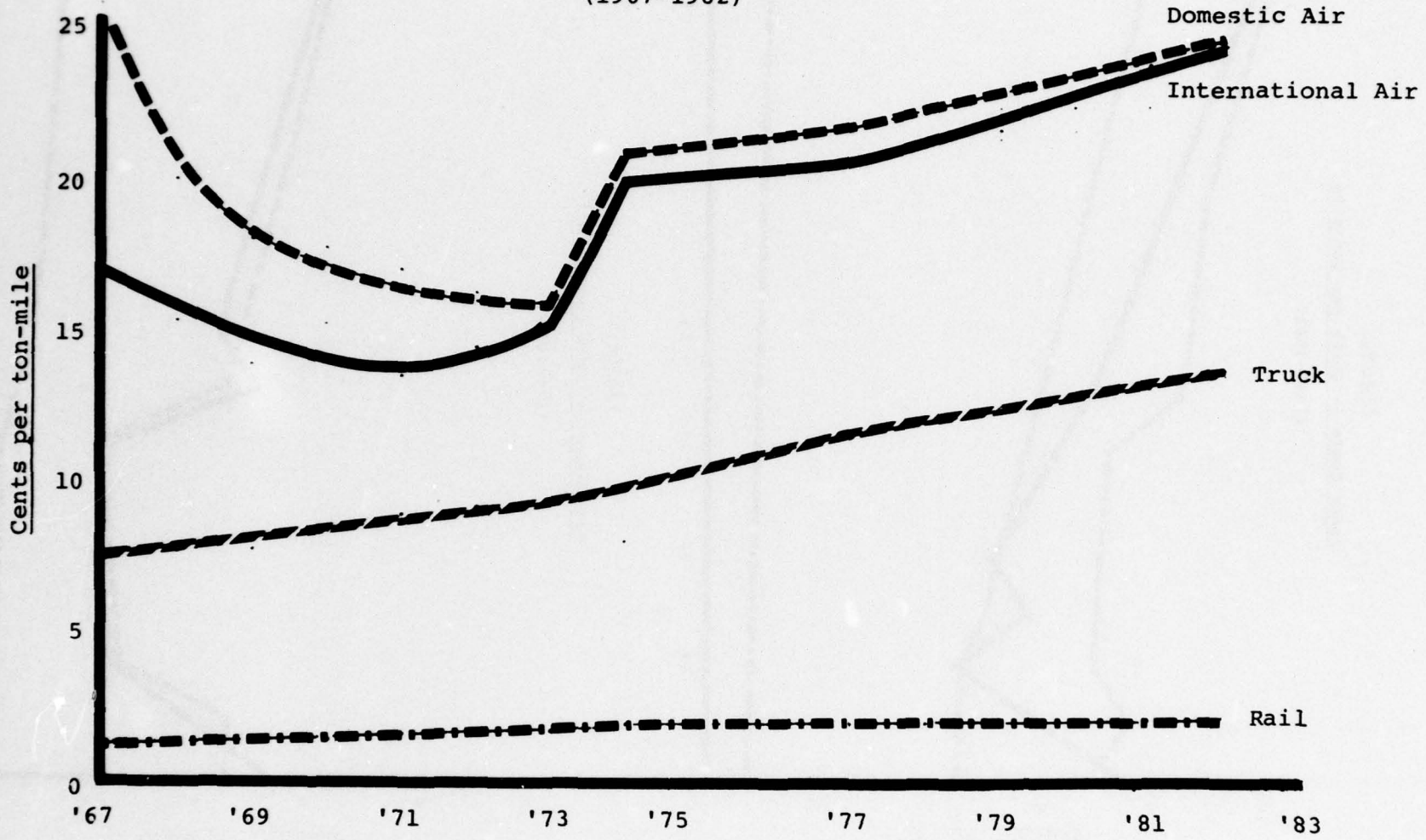


Figure 9

Total Costs -- Cents per Ton-mile

(1967-1982)



and supplies costs will be required to overcome past deferrals in maintenance and capital expenditures for roadbed and rail track.

Depreciation costs. Depreciation costs, as a proportion to total costs, are expected to decline for all modes. This results from a variety of considerations including: the lack of significant technological changes during the forecast horizon, disproportional increases in other cost categories, and relatively level or declining net investment.

3. Investment factors.

One of the major challenges to the transportation industry during the next several years will be to attract the capital necessary to replace depleted assets and continue to grow. Although capital investments in the transportation industry have more than doubled in the last 25 years, the ability to generate investment funds has been losing ground to other industries. In 1950, the regulated transportation industry accounted for nearly 12 percent of the total expenditures by all business for new plant and equipment. By 1974, this had dropped to just under 6 percent with railroads experiencing the largest decline.

The growth of private and public debt is a significant deterrent to capital formation for the commercial transportation sector. As less capital becomes available for investment, only the more creditworthy firms will be able to secure the available funds in sufficient quantities to satisfy their needs. Inadequate earnings, relative to the rest of the economy, are the major reason for the reduced ability of transportation to attract capital.

4. Management trends.

In the transportation industry, the general trend is toward fewer, larger carriers. There is also a tendency toward conglomerate ownership. This should strengthen the industry, providing controls can be developed to cope with the growth in size.

D. National Policies Affecting Transportation

1. Defense.

The ability of defense policies to influence the course of civil transportation development, short of major U.S. military involvement abroad, is diminishing gradually since military tonnage is becoming a smaller portion of an expanded traffic base for

commercial transport operators. This is due to:

a. Reductions in overseas military activity which have resulted in less military tonnage moving via the commercial sector, and

b. Improvements in the economy which have expanded the volume of commercial freight. Commercial transport operators are becoming less dependent upon military business.

Major defense policies are centered around readiness programs which have had varying degrees of success. The Highways For National Defense Program has met its goal of incorporating defense considerations into highway construction. However, Civil Reserve Air Fleet (CRAF) Program has its limitations, particularly in the movement of oversized cargo. The Railroads For National Defense Program has just begun, and it is too early to determine the degree of success; but it will not be as easy to modify privately owned rail facilities as it was to help design the publicly owned highways.

2. Environment.

The principal costs of environmental policies are being reflected in higher taxes for government research and regulation; increased research by industry; modified operations (e.g., jet curfews), and inability to build and expand highways, airports, locks and dams, and harbors to meet future transportation needs. In general, these concerns have made ownership and management of transportation enterprises more complex and will result in higher costs to shippers.

3. Energy.

It is projected that the petroleum supply for transportation is likely to remain reasonably adequate during the forecast period, and prices will stay within reasonable and predictable increase limits. Modal shifts are expected to be minimal with increased fuel prices. Due to the existing large cost and service differentials among the modes, marginal changes in relative costs due to the differential impact of increased fuel prices are not expected to have a significant effect on modal choice for most freight.

E. Transportation Policies

Governmental transportation policies take two principal forms -- promotional and regulatory.

Promotional policies are primarily reflected in financial assistance programs for capital improvements. They may be in the form of loans, subsidies, grants or guarantees. Most familiar are the Interstate Highway Program, with its related Highway Trust Fund, and the Airport and Airway Development Program, with its related Aviation Trust Fund.

Regulatory controls over transportation are primarily in the fields of economics, safety, and, more recently, environment and energy.

Some of the recent developments and trends in these areas of policy are as follows:

1. Promotional policies.

Current federal transportation promotional policies are designed to treat all modes more even-handedly and insure that each pays its fair share of the cost of government services. Major promotional programs are included in the recently passed Railroad Revitalization and Regulatory Reform Act of 1976. This Act provides $6 billion for rehabilitation and modernization of rail trackage and services, subsidies for light-density lines and financing for ConRail. The Act also provides for the development of a rational rail system through elimination or downgrading of nonessential routes and encouragement of mergers. These programs will provide a valuable boost to the railroad industry and provide some balance with the highway and other programs.

User charges for highway and air carriers will continue under recent legislation, and a competitive advantage of inland waterways operators may be reduced if the proposed user charges are imposed. Other promotional policies which may affect the railroads are the legislative uncertainty of (1) eminent domain for slurry pipelines and (2) the proposed authorization for upgrading locks and dams on the Mississippi River.

2. Regulation.

The regulatory constraints on each of the modes vary considerably. The near future should see some of these disparities reduced. In general, the trend will be toward less economic regulation of air, truck, and rail carriers, while safety provisions will increase for the truck and rail modes. The opposite movement of these regulations will have a somewhat counterbalancing effect on the transportation industry. Relaxed economic regulation will aid more efficient operations and reduce government costs. Increased safety regulations on truck and rail carriers will mitigate some

of these gains by adding costs of compliance without corresponding productivity gains.

The major emphasis in economic regulatory policy at present is to allow transportation to be more competitive both within and between modes to provide better service at lower costs. This objective is being sought through legislative changes in the economic regulation of the rail, motor carrier, and airline industries, with particular emphasis on liberalizing entry and exit requirements; providing carriers with pricing flexibility; speeding up the regulatory process (with stress on mergers, consolidations and rates); and reducing the powers of rail and motor carrier rate bureaus.

F. Technological Developments

No revolutionary technological developments are anticipated within the next five years, although there will be evolutionary advancements in several areas. Support facilities and services -- communications, management information systems, and automated terminal functions -- will be the major areas of change and improvement. There are several reasons for this:

1. There is a basic need for improvements in these areas;

2. Much of the major improvement potential has been achieved in the line-haul sector (vehicles, power plants, and enroute navigation facilities);

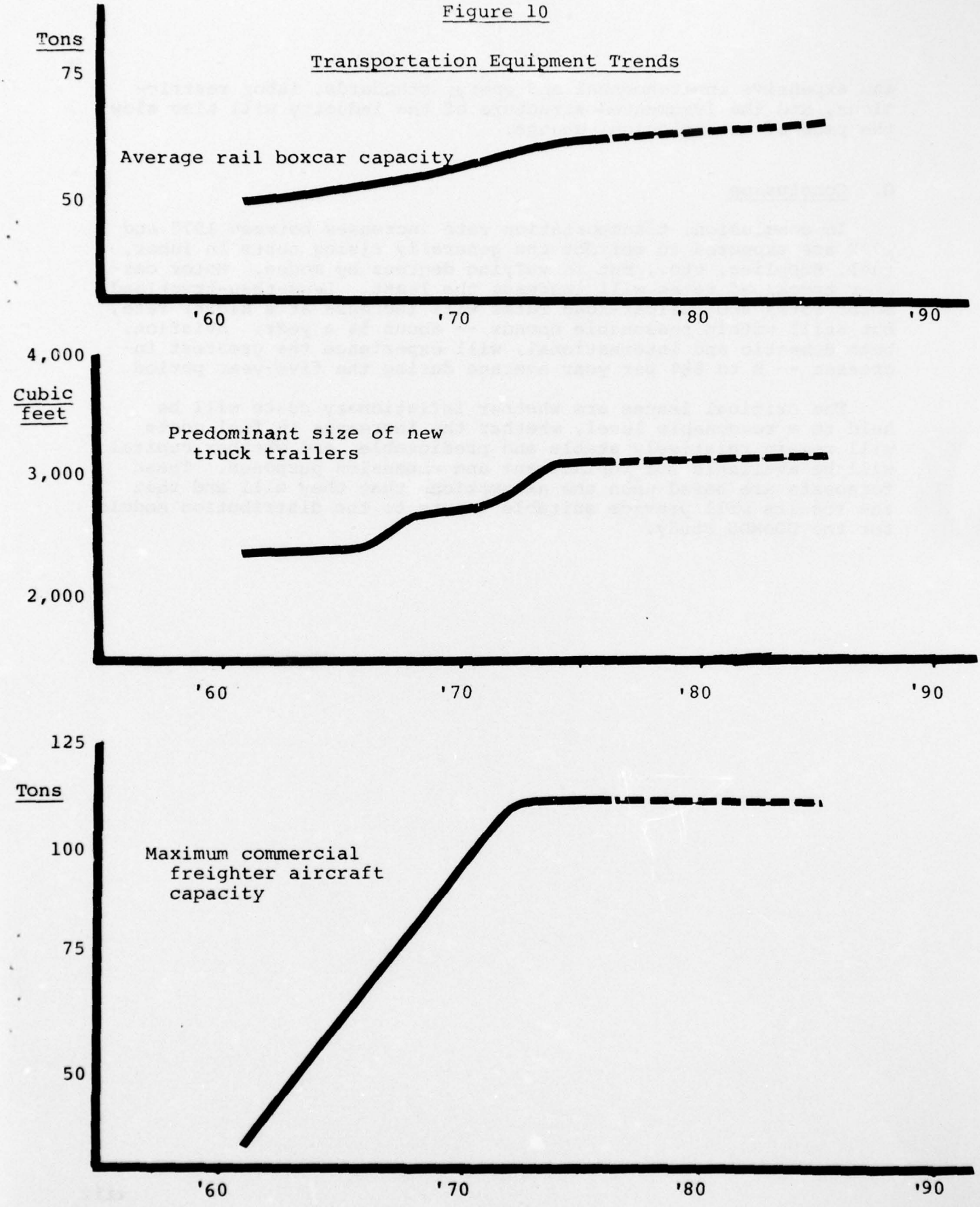
3. Computer and related control applications are currently among the most dynamic in technological change.

Few dramatic changes in size, speed, and capacity of transportation vehicles are likely in the next five to ten years. Figure 10, Transportation Equipment Trends, shows the past and expected trends. Highlighted are the slow, steady gain in average rail boxcar capacity, the periodic increase in truck trailer size, and the rapid increase in freighter aircraft capacity with the introduction of the B-747F. Average railcar capacity is expected to increase slowly as new, larger cars replace older, smaller equipment. Size and weight limits will preclude larger trailers. No new large cargo aircraft are expected to be operational in the next several years. Technologically, there are opportunities for improvements; however, these potential advances will be tempered by energy, environmental, and support facility constraints.

Some constraints to technological development are more institutional than technical. The major deterrent will be lack of capital, as large-scale investments will be required simply to meet new social requirements without any resulting increase in productivity. Regulatory provisions that inhibit innovation, complex

Figure 10

Transportation Equipment Trends



and expensive environmental and energy standards, labor restrictions, and the fragmented structure of the industry will also slow the pace of technological change.

G. Conclusion

In conclusion, transportation rate increases between 1977 and 1982 are expected to reflect the generally rising costs in labor, fuel, supplies, etc., but in varying degrees by modes. Motor carrier truckload rates will increase the least. Less-than-truckload motor rates and railcar-load rates will increase at a higher rate, but still within reasonable bounds -- about 5% a year. Aviation, both domestic and international, will experience the greatest increases -- 8 to 8½% per year average during the five-year period.

The critical issues are whether inflationary costs will be held to a reasonable level, whether the increases in fuel costs will remain relatively stable and predictable, and whether capital will be available for replacement and expansion purposes. These forecasts are based upon the assumptions that they will and that the results will provide suitable inputs to the distribution models for the DODMDS Study.

SECTION I

INTRODUCTION

As part of its technical support to the Department of Defense Materiel Distribution System (DODMDS) study, Drake Sheahan/Stewart Dougall Inc. is developing transportation cost inputs for modeling the DOD Materiel Distribution System (Contract NOO600-76-C-0508, 31 October 1975).

The three tasks inherent in that input are:

1. A forecast of future U.S. commercial transportation capabilities to provide insights for tactical and strategic managerial decisions.

2. Recommendations for operational improvements in the transportation segment of the DOD Materiel Distribution System.

3. The development and formatting of weighted average transportation rates for cost inputs into the DODMDS models.

This last task binds the three together since it calls for costing of transportation under the present system, under an improved present system, and under alternative future systems.

This Report consists of two major elements: (1) a forecast of freight rate increases to the year 1982, and (2) a review of significant developments that will impact the commercial transportation modes that are important to the DODMDS. This effort concentrates on those modes most significant to the DOD Wholesale Materiel Distribution System. Thus, inland water and pipeline transportation are mentioned only in relation to their impact on other modes. Due to the fact that commercial ocean rate forecasts were provided through government channels, this mode is not embraced in this Report.

We are indebted to many people for their cooperation in assisting us with this research, including: staff members of Congressional Committees; officials of the Department of Transportation, the Interstate Commerce Commission, and the Civil Aeronautics Board; officials of the Air Transport Association of America, the American Association of Railroads, the American Institute of Maritime Shipping, the American Association of Port Authorities, and the American Trucking Associations; and officials of the Military Sealift Command, the Military Traffic Management Command, and the Military Airlift Command.

Background

This study for the DOD Materiel Distribution System Study Group is a forecast of future U.S. commercial transportation costs and capabilities. Its purpose is to provide insight for tactical and strategic managerial decisions based on an assessment of future U.S. commercial transportation developments, and to develop a transportation forecast for input to the weighted average freight rates which are transportation cost inputs to the distribution models. Specific modal forecasts are provided for carload, truckload, less-than-truckload and both domestic and international air shipments. The results are summarized in this Report.

Concept of the Forecast

This forecast embraces both quantitative data and qualitative factors. The two aspects are melded together to obtain a perspective of the cost structure and capabilities in a five-year time frame. The rate forecast is based on the general principle of projecting the trend of various carrier cost elements and measuring the revenue needs under certain investment considerations and profit goals. It is based on historical cost data for each of the modes modified to project the trends that can be anticipated in specific transportation rates in the various modes. The principal cost elements measured are labor, fuel, material and supplies, depreciation and taxes.

The qualitative factors include discussions of the impact upon commercial transportation of national policies and programs relating to national defense, economic development, energy conservation and availability, human resources, and environmental protection. In addition, the potential effects of economic, safety and environmental regulatory policies, technological change, financial condition of the transportation industry, and industry ownership trends are discussed.

Assumptions

The forecast is based on the premise that increases in cost factors will impact uniformly all geographic territories and commodity types. Thus, it assumes that existing territorial and commodity differentials will be maintained. Further, it is assumed that there will be a continuation of past trends in the rate of increase for most cost elements. Two exceptions to this assumption are fuel costs and railroad maintenance costs, both of which have experienced aberrations recently necessitating individual treatment.

The forecast is also predicated on the continuation of past productivity levels and trends. In addition, the historical and projected data associated with Class I railroads, Class I motor carriers, and all-cargo airlines will be representative of their respective industries as a whole.

The forecast has been structured, however, so that the rate of increase in cost elements and productivity trends can be isolated and adjustments made to reflect differing economic, regulatory, and technological changes.

Methodology

The forecast projects the magnitude of increase in individual cost factors, i.e., fuel, labor, material and supplies, depreciation, taxes, etc., and discusses the more qualitative factors.

In addition to developing the historical cost and rate information, we have verified and modified our work, as appropriate, to take into account official federal government forecasts and other data sources such as the Department of Commerce and Labor Department sources on Economic Activity Projections, Occupational Outlook Productivity measures, "U.S. Industrial Outlook for 1975 with Projections to 1980," the President's Economic Reports to the Congress, the Department of Transportation's "1974 National Transportation Report," and the "National Transportation Statistics," as well as the statistics and data from ICC, CAB, FAA and the modal transportation associations. Valuable insight was also obtained through our previous work for industrial and government clients.

The end-product of this effort contained in Section II of this Report is a forecast of transportation rates which are a transportation cost input into the DODMDS model for developing an optimum Defense Distribution System for military materiel.

The qualitative aspects of this Report are summarized in Section III and a broad look at each of the principal modes is contained in Section IV, Future Railroad Developments; Section V, Future Motor Carrier Developments; and Section VI, Future Airline Developments. Each Section identifies and discusses significant national policy, ownership, economic, regulatory, and technical factors that are likely to influence the availability and cost of commercial transportation for defense purposes in the next five to ten years. Sections III to VI were developed by a careful review of the latest literature available on transportation developments, supplemented by a series of interviews with key government and industry people, whose knowledge and opinions provide additional bases for evaluation of the trends and developments.

SECTION II

TRANSPORTATION RATE AND COST TRENDS

A summary of our forecast for general freight rate increases by mode is presented in Figure II-1. This forecast, as developed in Exhibit B -- Forecast of General Freight Rate Increases -- is the end-result of our effort to analyze, evaluate, and project the impact of various quantitative and qualitative factors upon transportation costs and is based upon the methodology described in Exhibit A -- Forecast Technique. The manner in which cost and investment factors were used in developing a quantitative forecast is outlined in this Section. A detailed discussion of the qualitative inputs is contained in Section III.

Overall, the most potent forces prompting the need for higher freight rates are national economic conditions accentuated in the transportation field by higher labor and fuel costs. Offsetting these pressures are increased productivity through improved vehicles, operating methods, and procedures, which lower operating costs, and the impact of the marketplace -- particularly intermodal competition.

As can be seen in Figure II-2, there is a wide range in the expected increases resulting from differing rates of increase in operating costs, expected increases in tonnage, and levels of productivity increases. For example, international air rates are projected to increase at an average annual rate of 8.75 percent, whereas motor carrier truckload rates are projected to increase on an average of only 2.7 percent. Further, a larger rate of increase is projected for all modes in the earlier years of the forecast. This trend results from the fact that a constant rate of increase is being applied to an expanding base and is clearly illustrated in Figure II-3.

Forecast Techniques

The DS/SD forecast is predicated on the assumption that, given current carrier cost trends and revenue needs under various long-term investment considerations and profits goals, freight rate increases can be projected. This basic technique is similar in concept to that employed by the Interstate Commerce Commission (ICC) and Civil Aeronautics Board (CAB) in reviewing carrier requests for freight rate increases. Carriers report their costs and use the result as justification for increases in petitions to the regulatory agency which, in turn, allows, denies, or modifies the requested increase. The agency considers the need of the carriers as measured by the operating ratio or return on investment in its analysis and decision-making process.

This forecast uses essentially the same process. The essential difference is that the regulatory agencies evaluate rate increase petitions based upon immediate need, whereas DS/SD is projecting future

Figure II-1

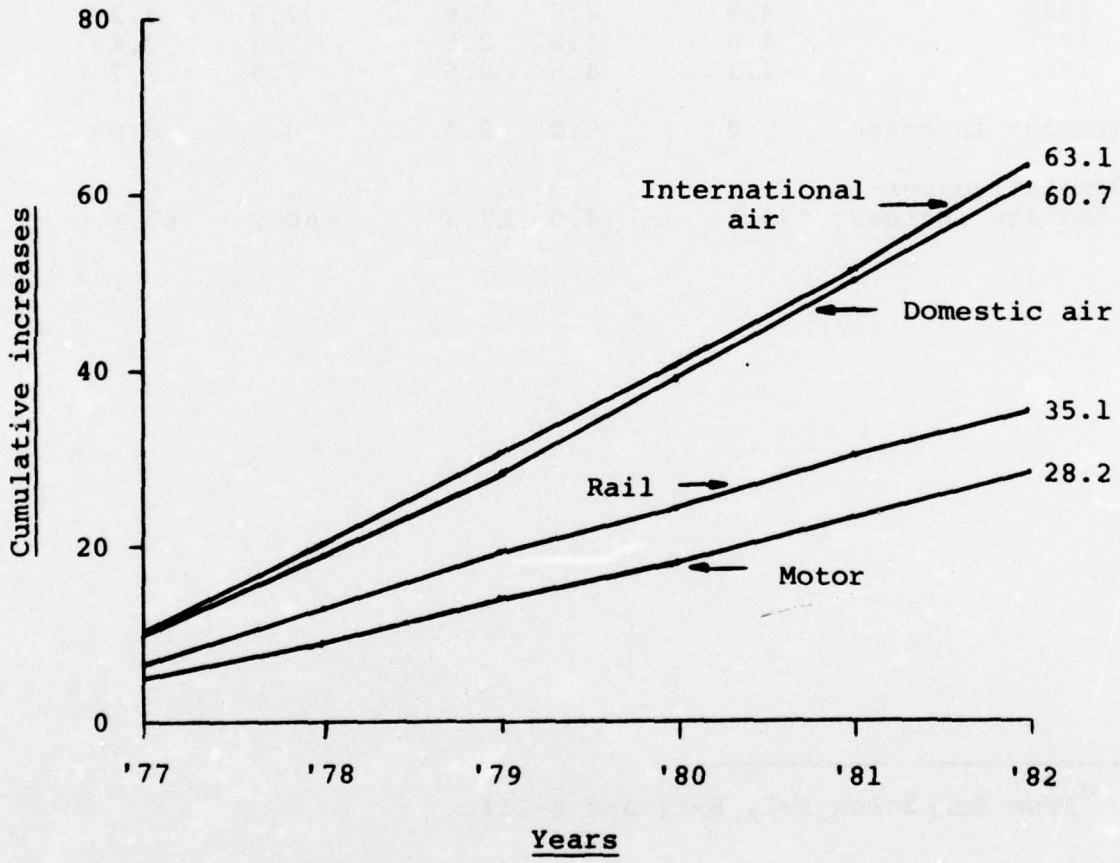
Forecast of Freight Rate Increases -- 1977 Through 1982
(Percent)

	Mode[a]				
	Rail	Motor		Air	
Design year	CL	LTL	TL	Dom.	Inter.
1977	6.2	5.8	3.1	9.8	10.1
1978	6.2	5.2	2.8	8.4	8.9
1979	5.2	4.8	2.6	7.9	8.3
1980	4.8	4.8	2.6	7.9	8.2
1981	4.4	4.8	2.6	7.9	7.8
1982	4.1	4.6	2.5	7.5	7.7
Average increase	5.2	5.0	2.7	8.3	8.5
Cumulative percentage increase	35.1	34.0	17.3	60.7	63.1

[a]From Schedules B-I, B-II and B-III.

Figure II-2

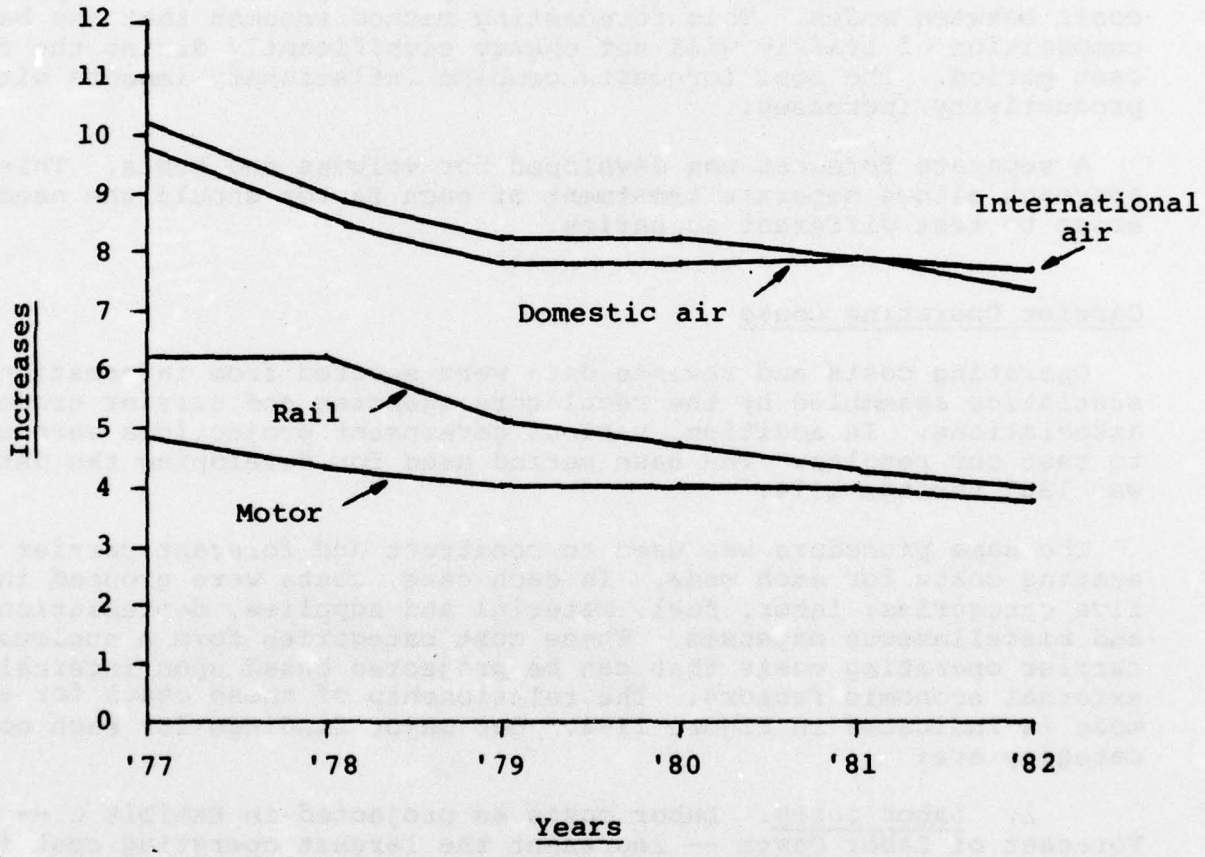
Cumulative Freight Rate Increases --
1977 Through 1982
(Percent)



Source: Drake Sheahan/Stewart Dougall, March 1976.

Figure II-3

Projected Rate of Increase in Freight Rates -- 1977 Through 1982 (Percent)



Source: Drake Sheahan/Stewart Dougall, March 1976.

requirements. Cost element increases are projected and the impact on the operating ratio and investment criteria is measured. The revenue increases necessary to meet the cost and investment factors are then determined.

A variety of comparisons was made with various published data to test the validity of our projections. These tests, without exception, support the costs as we developed them. The results are summarized in Exhibit H -- Comparisons of DS/SD Projections with Other Sources.

Carrier costs are composed of three major factors -- inflationary price increases per unit, the impact of productivity, and changes in volumes. To measure these factors, the costs developed for each mode have been converted to per-ton-mile costs. Total carrier revenues have also been converted into a per-ton-mile basis. This approach reduces overall projected revenue needs to a common unit of measure which is used for forecasting carrier operating costs and comparing costs between modes. This forecasting method assumes that the basic composition of traffic will not change significantly during the forecast period. The cost forecasts combine inflationary impacts with productivity increases.

A separate forecast was developed for volumes and costs. This approach allows separate treatment of each factor should the need arise to test different scenarios.

Carrier Operating Costs

Operating costs and revenue data were secured from information and statistics assembled by the regulatory agencies and carrier trade associations. In addition, various government projections were used to test our results. The base period used for developing the data was 1967 through 1974.

The same procedure was used to construct and forecast carrier operating costs for each mode. In each case, costs were grouped into five categories: labor, fuel, material and supplies, depreciation, and miscellaneous expenses. These cost categories form a nucleus of carrier operating costs that can be projected based upon internal and external economic factors. The relationship of these costs for each mode is indicated in Figure II-4. Our major findings for each cost category are:

1. Labor costs. Labor costs as projected in Exhibit C -- Forecast of Labor Costs -- represent the largest operating cost for all modes and, with the exception of the recent fuel costs, have been increasing at a faster rate than any other operating cost category. The largest rate of increase in labor costs of from 38.5 percent of total cost in 1976 to 41 percent by 1982 is projected for the international all-cargo airline industry. This reflects the relatively high cost per employee in this industry. Domestic all-cargo airlines and motor carriers labor costs are expected to remain stable as a percentage of total operating expenses during the study time frame. The

Figure II-4

Composition of Carrier Operating Costs -- 1976 and 1982

Operating costs	Composition of costs (percent)							
	Rail		Motor		Air			
					Domestic		International	
	1976	1982[a]	1976	1982	1976	1982	1976	1982
Labor	54.3	49.7	58.2	58.9	41.1	41.9	38.5	41.0
Fuel and oil	9.1	11.3	10.5	11.7	22.8	26.5	24.1	26.3
Material and supplies	18.8	20.0	14.6	13.9	3.8	4.0	3.6	3.2
Depreciation	5.4	4.6	3.0	2.6	7.2	6.2	6.1	4.9
Miscellaneous	12.5	14.4	13.7	12.9	25.1	21.4	27.7	24.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Drake Sheahan/Stewart Dougall forecast of carrier operating costs -- Exhibits C through G.

[a]Does not include adjustments made in total projected material and supply costs arising from forecasted expenditures to rebuild the nation's rail track system.

only mode expected to experience a decline in labor operating costs from 54.3 percent in 1976 to 49.7 percent in 1982 is the railroad industry. This trend results from continuation of an overall decline in the number of employees coupled with expected increases in ton-miles.

2. Fuel costs. Since the Arab Oil Embargo, fuel costs, as developed in Exhibit D -- Forecast of Fuel Costs -- have escalated faster than any other carrier operating costs. Almost all modes have experienced at least a 100 percent increase in fuel costs since 1973. The airline industry was most adversely affected by these increases with fuel costs now constituting over 20 percent of their operating costs. By contrast, rail fuel costs increased from approximately four percent in 1973 to nine percent today. Similarly, motor carriers fuel costs have increased from four percent to over ten percent.

A relatively moderate rate of increase in future crude oil prices ranging from six to seven percent per year has been projected by both the Federal Energy Administration and the Federal Aviation Administration through 1990. Therefore, DS/SD used these forecasts to project fuel costs for all modes. As a result, carrier fuel costs are not expected to increase disproportionately as was the case for the 1973 to 1975 time frame.

3. Material and supplies costs (other than fuel and oil). Material and supplies as projected in Exhibit E -- Forecast of Material and Supplies Costs -- represent the second largest operating cost for the railroad industry. This stems from the fact that only the railroads have significant costs associated with maintaining the right of way. The total cost of material and supplies for the rail industry in 1976 is expected to be over $3 billion which amounts to almost 19 percent of their operating costs. Large increases in material and supplies costs are required to overcome past deferrals in maintenance. The Federal Railroad Administration has estimated that, on a nationwide basis, at least $9 billion of additional capital is needed to upgrade and replace deteriorating sections of rail tracks. These expenditures are reflected in the material and supplies costs category of the DS/SD forecast for future rail expenditures by adding an additional $1 billion per year starting in 1977 to the projected material and supplies costs.

Material and supplies account for the smallest percent of cost in the all-cargo airline industry and are expected to maintain their relative proportions through the forecast horizon. A slight downtrend is anticipated in the relative importance of material and supplies costs for the motor carrier industry.

4. Depreciation costs. Depreciation as an operating expense projected in Exhibit F -- Forecast of Depreciation Costs -- is expected to decline for all modes. This results from a variety of considerations including: the lack of significant technological changes during the forecast horizon, disproportional increases in other cost

categories, and stagnated or declining net investment. The most significant declines are expected for rail and air. For example, rail depreciation is projected to decline from 5.4 percent of operating costs in 1976 to 4.6 percent in 1982. Net investment has actually declined in the rail industry for the last 20 years, and we expect this trend to continue for the forecast horizon. Similar declines are also projected for the all-cargo airlines industry. For both the domestic and international segments, present capacities are expected to be sufficient to accommodate future volumes; therefore, no significant expenditures are anticipated.

5. Miscellaneous costs. The miscellaneous cost category as projected in Exhibit G -- Forecast of Miscellaneous Costs -- contains the operating costs not classified as labor, fuel, material and supplies, or depreciation. Given the number of different cost items that were lumped together, the cause and effect of relative changes in this category were not researched in any depth. We did note that miscellaneous costs are expected to increase in relative importance for rail, while declining for the motor carrier and air cargo industries.

Investment and Profit Considerations

Commercial transportation companies are commanding less and less of the available capital although doubling their capital investment in the last 25 years. The regulated transportation industry in 1950 accounted for nearly twelve percent of total business expenditures for new plants and equipment but, by 1974, this had dropped to six percent. Sharp declines in overall earnings for many transportation companies have contributed to the decline. Reduced profitability and the resulting inability to command the financial commitments necessary to maintain investment have impacted the modes differently:

1. Rail. The rail industry has suffered greatest in terms of its ability to generate capital investment. Since 1967, the rail industry as a whole has averaged only a 2.6 percent rate of return on investment. To remain in the private sector, access to private funding will require that railroads improve their long-range ROI. This improvement, however, is likely to be gradual since competition from other modes and consumer reluctance to accept large rate increases will act as a deterrent. Recognizing this need for improved profitability, DS/SD has projected a three percent ROI for the railroads industry in 1976 and 1977. This has been gradually improved by one half of one percent for each subsequent year of the forecast resulting in an overall ROI of 5.5 percent by 1982. A continuation of this trend through the 1980's would place the nation's railroads in a position to compete with other industries and government for available capital.

2. Motor. The motor carrier industry has experienced an operating ratio averaging 95 percent since 1967. This has enabled motor carriers to obtain rates of return on equity up to ten to fifteen percent. This favorable return on equity, coupled with the relatively

limited investment requirements of the motor carrier industry, has allowed them to attract the capital they require. A continuation of this operating ratio and associated ROI has been projected for the forecast horizon.

3. Air. The domestic all-cargo industry has experienced financial hardship during our base period. Operating expenses have exceeded income for several years resulting in an average operating ratio of 102 percent and a negative return on investment. On the other hand, international all-cargo operations have experienced an average operating ratio of approximately 88 percent for the same period resulting in a return on investment of approximately from twelve to fifteen percent. This rate of return is sufficient to afford the capital required by the international all-cargo industry and has been projected for the forecast horizon. The financial position of the domestic all-cargo airlines threatens its very existence. The prospects for improvements are not good since they face competition from both the passenger/cargo airlines as well as various forms of intermodal competition. However, they cannot continue to operate at a loss. Therefore, we have improved their operating ratio to 100 which is a break-even point. While this will not generate a favorable ROI, we do not anticipate further improvement for the forecast horizon.

Qualitative Factors

The purely quantitative projections of past trends have been adjusted, as in the case of fuel, material and supplies, and investment requirements, by qualitative inputs. There are other less tangible qualitative considerations which should be recognized. After due consideration of each, we conclude that the rate of growth in the Gross National Product and the rate of inflation will be the factors which most directly impact the rate of increase in transportation costs. A discussion of the qualitative issues is contained in Section III of this Report. A brief review of those which tend to impact most directly on operating costs includes:

1. Rail. The railroad industry is undoubtedly going through a more traumatic period than any of its competitors. There are obviously some favorable and unfavorable results that can flow from this in terms of future costs and rates to shippers.

Favoring higher freight rates are the following factors:

- A great need for more revenues to produce a higher rate of return on capital investment.
- Labor and fuel increases.
- Potentially more flexible pricing to meet rising costs sooner.
- Additional costs for safety features.

Influences which tend to moderate or hold down freight rates include the following factors:

- Large infusions of federal low-interest or debt-free capital to establish ConRail and assist other railroads.
- Federally funded railroad research and development.
- Elimination of duplicative and discriminatory state and local taxation.
- Reduction of costs through abandonments or discontinuance of service or unprofitable segments of track.
- Need to keep prices down to retain tonnage or attract new business from competitive modes.
- Improved operating practices and procedures.

2. Motor. The motor carrier industry will also be faced with conflicting pressures for freight rate increases and decreases. The principal factors influencing higher costs and rates include:

- Labor and fuel costs will continue to be large individual costs and probably larger percentages of total costs.
- Inflation will affect all costs.
- Potentially greater price flexibility will result from regulatory reform.
- Additional safety and environmental costs are expected.
- Continued lower productivity is expected from the 55 m.p.h. restriction.

Factors favoring lower costs and/or rates are:

- Free or liberalized entry could instill more competition.
- Rail competition may be more effective in some areas.
- More flexible pricing either inside or outside the rate bureau mechanism may encourage lower rates.
- Possible liberalization of weights and lengths can improve productivity.

3. Air. In the airline industry, there are also a number of pluses and minuses that must be taken into consideration when predicting future freight rate levels.

Factors that may cause higher costs and rates include:

- Fuel and labor costs are expected to remain high.
- Other costs will keep pace with inflationary trends.
- Technological breakthroughs are not expected to increase productivity enough to offset rising costs.
- Greater pricing flexibility is anticipated from regulatory changes.
- Additional environmental regulation will add some cost.

Among the factors that will tend to hold rates down are:

- The airlines are actively promoting air cargo business to increase revenues.
- Ticket and waybill taxes might be reduced.
- The regulatory climate will encourage more competition.
- The narrow-bodied jets are at or near the end of their depreciated life and many of the wide-bodied jets are well into their depreciation cycle.
- Operating efficiencies will continue.
- Competition will remain keen with aggressive foreign competitors.

On balance, fuel prices and inflation may well be the most important factors domestically. Internationally, competition with foreign carriers and less controllable fuel costs will be of prime importance.

SECTION III

SUMMARY OF TRANSPORTATION AND TRENDS

The future commercial transportation capabilities and developments of particular interest for defense tactical and strategic managerial decisions involve consideration of a number of factors. We have grouped these into related areas which are:

Part A -- Nontransportation Policies outlines those policies with can and do impact transportation, such as energy, environment, human resources, and defense, but which are not directly intended to deal with transportation problems.

Part B -- Transportation Policies and Regulatory Trends discusses the various regulations intended to promote, direct, and control transportation developments.

Part C -- Economic and Management Trends reviews the external economic, and internal financial, and management issues that affect transportation.

Part D -- Technological Developments outlines the technological factors that will impact transportation.

Each of the issues discussed in these four Parts is covered as it applies to the various modes in the Sections which follow this Section of the Report.

Part A

Nontransportation Policies

Defense Policies

The interdependence of military and commercial transportation was recently re-emphasized by a Defense Department official who stated, "The defense transportation system must rely in peacetime and wartime on a strong civilian transportation capability."[1/] In today's environment, two factors interact to reduce the relative significance of military considerations:

1. Reduction in military activity has resulted in less military tonnage moving by the commercial sector;

2. Improvements in the economy have expanded the total volume moved by the commercial sector.

As a result, military tonnage is a smaller and smaller portion of a larger base which means that commercial transport operators are becoming less dependent upon military business. Therefore, the ability of defense policies to influence the course of civil transportation development, short of major U.S. military involvement abroad, is becoming diminished.

There are defense readiness programs related to highways, railroads, and air carriers which are in various stages of development:

> The "Highways for National Defense" Program is legislatively tied to the Interstate Highway construction program and is considered to be an effective program. It is expected to continue and is not expected to deviate from its roadway orientation.
>
> A "Railroads for National Defense" Program is in the preliminary stage and its outcome is not clear. It seeks to accomplish the same thing with privately owned rail rights-of-way that has been done successfully with the publicly owned highways. It is dependent upon the development by the Department of Transportation of an economically viable national rail network which will encompass defense requirements. To become effective, it will require legislation which has not yet been introduced.
>
> The "Civil Reserve Air Fleet" Program appears to have limitations, particularly the ability to airlift "oversize" cargo. Additional large wide-bodied civil aircraft are needed for this purpose. However, the normal growth of commercial air cargo will not justify acquisition of significant numbers of the wide-bodied aircraft needed for this purpose by the airlines within the

next few years. Air Force efforts to convince Congress of the need for additional military aircraft for this purpose, or to provide a military subsidy for the "Airlift Enhancement" Program, have not yet been successful. The airlines claim that if a much larger proportion of military cargo went by civil airline, they could justify the purchase of new cargo aircraft, but this is not agreed to by Defense.

Environmental Policies

The major environmental policies impacting transportation are the National Environmental Protection Act of 1969 (NEPA) and the Clean Air Act of 1970. NEPA requires that every major public decision that could impact the environment include an environmental impact assessment. If the environment is found to be adversely affected, a conforming alternative must be found or the project abandoned. The Clean Air Act tightens allowable emission standards.

The most immediate impacts were in highway and airport construction and all applications before the various regulatory agencies. Many highway segments were held up, rerouted or abandoned as were runway extensions, and new runways on airports. To date, none of the modes has been seriously affected by the more stringent air standards, although this situation is expected to change with the airlines and motor carriers being most vulnerable.

Aviation has been most severely affected by the environmental regulations. Noise abatement programs have become increasing expensive. For example, night flights (which are best for cargo operations) at many airports have been restricted or eliminated. Alternatives for complying with the noise standards include:

1. "Retrofit" the DC-8s, Boeing 707's, and other early aircraft still in use.

2. Increase the size of noise buffers around airports through additional land purchase.

3. Allow new, quieter aircraft to gradually replace, through attrition, the older planes currently in use.

Through inaction, the latter will probably prevail although, where feasible, aircraft operational improvements and acquisitions will continue.

Among the other modes, none has yet had any serious impacts. Railroads have been precluded from abandoning some light-density lines because the environment would be adversely affected by the additional truck traffic that would be generated. This impact has been eliminated by the Railroad Revitalization and Regulatory Reform Act of 1976 (RRRRA)

which authorizes subsidies for these light-density lines, thereby removing the economic burden of these track segments. Truckers have been exempt so far from noise and emission controls, but that is not expected to last indefinitely. However, at this time, the financial impact on the industry is difficult to assess.

The principal costs of environmental policies are being reflected in higher taxes for government research and regulation; research by industry; modified operation (e.g., jet curfews), and inability to build highways, airports, locks and dams, and expand harbors to meet future transportation needs. In general, these concerns have made ownership and management of transportation enterprises more complex and will result in higher costs to shippers, at least during the transition while these costs are absorbed.

Energy Policies

The goals of U.S. energy policies are to (1) increase the domestic supply, (2) restrain demand, and (3) facilitate more efficient use of energy resources. The most recent instrument of this policy, The Energy Policy and Conservation Act of 1975 (EPCA), provides for increasing the supply of fossil fuels in the U.S. through price incentives and production requirements.[2/] Coal production is to be encouraged, more energy-efficient motor vehicles (also major appliances and other consumer products) are required, and energy conservation programs are authorized to conserve petroleum supplies. Other provisions of EPCA are: (1) Establish a strategic petroleum reserve of at least 150 million barrels of petroleum within three years and up to 400 million barrels in seven years. (2) Give the President standby energy emergency authority; and (3) Authorize participation in international energy programs. This law is expected to facilitate an increase in domestic petroleum production of more than a million barrels per day and reduce imports by about three million barrels per day by 1985.

In order to ease the transition while striving to reach the objective of a self-sustaining petroleum supply, temporary price controls have been authorized under the Act. Pricing of domestic "old" and "new" oil is subject to a composite price limit of $7.60 ("old" oil at $5.25 and "new" oil at $11.28 per barrel) which can be adjusted upward monthly to account for inflation and to provide a production incentive of not more than 3 percent per year (which together cannot exceed 10 percent per year). In addition, the Administration, subject to disapproval of either House, may further adjust the 3 percent and the 10 percent each 90 days.

These provisions expire 40 months from passage of the Act in December 1975. The Administration believes that, by that time, conservation programs and alternative energy sources will be sufficiently developed to preclude a rapid escalation in petroleum prices. The transportation industry has a big stake in the success of these programs. Transportation accounts for approximately 25 percent of U.S.

energy consumption and about 60 percent of U.S. petroleum consumption. Since, under current technology, there are no feasible alternatives to petroleum as a source of energy, the transportation industry is particularly vulnerable to disruption of supply such as the 1973 Oil Embargo and to the higher costs associated with these conditions.

There are indications that transportation users would receive a high priority in any future allocation programs, should they become necessary.

Utilities, industrial, and home heating uses can all be accomplished with energy sources other than petroleum, and extensive research and development efforts are under way to substitute coal, atomic, solar and other energy sources for those uses. If successful, transportation will have less competition for the available petroleum and prices could moderate. However, it is extremely doubtful this will happen within the next five years.

It is concluded, therefore, that the petroleum supply for transportation is likely to remain reasonably adequate during the forecast period, and that prices will stay within reasonable and predictable increase limits. Further, modal shifts are expected to be minimal with increased fuel prices. Existing cost and service differentials among the modes are sufficiently large that marginal changes in relative costs, due to the differential impact of increased fuel prices, are not expected to have any significant effect on modal choice for most freight. However, there could be some increased use of truck/rail intermodal containerization and possibly some shifting of petroleum shipments from water to pipeline. Air cargo is expected to be most adversely affected by higher fuel prices and this reduction in air cargo is expected to shift to truck. There could be some small shifting of truck freight to rail which would be more than offset by a shift of rail freight to inland water carriers. For international traffic, the total cost differential between air and ocean movement is so great that very little shifting is expected.

Part B

Transportation Policies and Regulatory Trends

The transportation policies of the U.S. are a combination of (1) Acts of Congress passed at various times for different reasons, and (2) the regulations and policies of the departments and agencies of governments -- federal, state and local -- that flow from the legislation. Notwithstanding the existence of the National Transportation Policy which is part of the Interstate Commerce Act,[3] the U.S. has never had a coordinated single transportation policy applicable to all modes. The Department of Transportation (DOT) issued a policy statement setting forth the goals of impartial treatment of all modes and insuring that each pays its own fair share.[4]

Specific national transportation programs are of two broad types: (1) Promotional encouragement of a mode primarily through capital financing programs for the "infrastructure" -- the support facilities and services; and (2) Regulation -- economic, safety, environmental and energy. A third one -- facilitation -- is just emerging.

Promotional Programs

Federal promotional programs of transportation include: (1) public financing of highways, waterways, airways, and, more recently, railways; (2) subsidies and loans for purchase of ships, airplanes, and rail equipment; (3) operating subsidies for ocean shipping, airlines and railroads; (4) research and development for ships and aircraft, and, more recently, for rail equipment, and (5) communications, navigation, traffic control, meteorology, and safety services for shipping and aviation.

The major accomplishment has been the Railroad Revitalization and Regulatory Reform Act of 1976 (RRRR),[5] which provides $6 billion for rehabilitation and modernization of rail trackage and services, subsidies for light-density lines and financing for ConRail. The Act also provides for the development of a national rail system through elimination or downgrading of nonessential routes and encouragement of mergers. These programs will provide a valuable boost to the industry.

Currently, the Administration is seeking legislative authority to impose user charges on inland waterway operators but is meeting the usual resistance from the barge industry and others. Imposition of these charges would aid the railroad industry by helping the railroads be more competitive with barge lines or water competitive traffic. Although there are forces, such as agriculture interests opposing this measure, it is projected that a moderate scale of user charges will be assessed against barge operators within the next few years.

The railroads could be affected adversely if current efforts to obtain the right of eminent domain for coal slurry pipelines are successful. This power would enable the building of pipelines across railroad land to transport western coal to the Midwest and Southwest in competition with the railroads. Particularly hard-hit would be the western railroads, such as the Burlington Northern. The measure is currently in Congress and has been held up pending further study. Passage of the bill during this session of Congress is unlikely; prospects beyond that are less clear.

Fuel taxes paid by truckers and motorists are paid into the Highway Trust Fund to support the highway program. The major controversy in this program concerns whether or not large, commercial trucks pay their fair share of user taxes. The Administration is on record as favoring a review to determine a fair allocation of user charges; however, it is doubtful significant changes will occur in the short-term future.

User charges for air cargo shipments will most likely continue for the next five years and beyond. Recent legislation entitled, "The Airport and Airway Development Act Amendments of 1976." has extended the application to operations and maintenance purposes.[6/] Previously limited to capital expenditures, the user charges are collected from shippers through a five percent air cargo waybill tax. There is no evidence of any expected changes in the current tax level.

Regulatory Trends

The regulatory programs flowing from our national transportation policies include: (1) economic controls, and (2) safety measures. The application and constraints on each of the modes vary considerably. The near future will see some of these disparities eliminated or reduced. In general, the trends will be toward less economic regulation, while safety provisions will increase. The opposite movement of these regulations will have a somewhat counterbalancing effect on the transportation industry. Relaxed economic regulation will aid more efficient operations with reduced bureaucratic costs. Increased safety regulations will mitigate some of these gains by adding costs of compliance without corresponding productivity gains. The major emphasis in economic regulatory policy at present is to make transportation more competitive both within and between modes to provide better service at lower costs. This is being sought through legislative changes in the rail, truck, and airline industries with particular emphasis on liberalizing entry and exit requirements; giving carriers some pricing flexibility; speeding up the regulatory process particularly in the matter of mergers, consolidations and rates; and reducing the powers of rail and motor carrier rate bureaus.

The tone of current policy was set by the Council of Economic Advisors, which recommended in its 1975 annual report:

"...more freedom for carriers to raise and lower rates without regulatory interference, greater freedom to enter markets and to exit from uneconomic services, and a narrowing of the regulator's power to grant anti-trust immunity."[17]

The Railroad Revitalization and Regulatory Reform Act of 1976 amends the Interstate Commerce Act to (1) speed up the hearing and appellate procedures with specific time limits for disposition of petitions for mergers, tariff modifications, etc.; (2) liberalize rate proceedings; and (3) place some restrictions upon rate bureau activities. The net effect of these changes should reduce the strictures on railroad management and make possible a more efficient operation, provide better service to shippers, and attract additional private financing to the industry.

Similar proposed legislation to rationalize motor carrier and airlines industries is before the Congress. Chances of passage this year are remote. The future of this legislation is contingent upon the outcome of the 1976 Presidential elections.

Regulatory provisions authorizing certain modes to provide transportation to the government at reduced rates have been under attack recently as being discriminatory against commercial shippers. Section 22 of the Interstate Commerce Act pertaining to common carriers under ICC jurisdiction is not likely to be changed in the next few years. General Accounting Office (GAO) studies on both truck and rail rates under Section 22 showed significant savings to the defense establishment; however, they also concluded that the rates were well above carrier costs.

In the area of safety regulation, the trucking industry will be more affected than other modes, although aviation will continue to be the most regulated in this field. The 55 m.p.h. national speed limit, present weight limitations, and proposed braking requirements will constrain productivity increases for motor carriers.

Impact of changes on the other modes will be less. The extension of user charges paid into the Airport Trust Fund to air navigation uses will tend to discourage any reduction in the amount of this tax. However, there is no evidence that any increases will be forthcoming. The railroad industry could be adversely affected by tighter regulation on movement of hazardous materials. The impact will be reduced as the roadbed is upgraded with the rehabilitation monies flowing in from the government.

Part C

Economic and Management Trends

Among the modes of transportation analyzed in this Report, the trucking industry has had the most consistent record of traffic growth and profits. For-hire trucking has grown from under 4 percent of total domestic ton-miles in 1947 to 11 percent in 1972 and is expected to go to 13.6 percent by 1990. Rail's share has been declining from 54 percent in 1947 to 33 percent in 1972 and is expected to be down to 30 percent by 1990.

Rate of return on equity continues to be higher for trucking than any mode except pipelines. By contrast, the rail industry has been earning less than three percent, and the air carriers have had minus earnings for several years.

Capital Investment

One of the major challenges to the transportation industry during the next several years will be attracting the capital necessary to replace depleted assets and continuing to grow. The growth of government and increasing public debt may well be the greatest deterrent to capital formation for commercial transportation private sector needs. Treasury Secretary William Simon recently reported to the Joint Economic Committee of Congress that federal, state, and local government borrowings now consume 82 percent of all savings allocated to capital growth. In the federal sector alone, this has risen from 18.6 percent in 1960, to 36.2 percent in 1970, and 72.2 percent in 1976.[8/] This also means that less and less capital is available for investment in the private sector and that only the more creditworthy firms will be able to secure the available funds in sufficient quantities to satisfy their needs.

In transportation, although capital investments have more than doubled in the last 25 years, the ability to generate investment funds has been losing ground to other industries. For instance, in 1950 the regulated transportation industry accounted for nearly 12 percent of the total expenditures by all business for new plant and equipment. By 1974, this had dropped to just under 6 percent with railroads suffering the most.[9/] Inadequate earnings, relative to the rest of the economy, are the major reason for the reduced ability of transportation to attract capital.

There is nothing to indicate a change in this trend in the next five years. The Transportation Association of America consisting of three groups (financial institutions, shippers, and carriers) has a special Transportation Investment Council working on the problem, but they have been unable to find a solution to date. It is stressing cash flow because the consensus is that most modes will be unable to generate investment funds in sufficient quantity to meet their capital needs.[10/]

The truck industry appears to be in better circumstances than the other modes. All capital investment is from private sources and the ratio of debt capital to equity capital declined from 37 percent in 1968 to 30 percent, or less at the present time, with a rate of return on equity of about 17 percent. The main unresolved issue is whether the fuel and other taxes being paid by the truckers is a fair share of the cost of highway construction and maintenance. It is expected that no major changes will occur in the next few years.

In the railroad industry the quantity of debt has not only increased to very high proportions, but the quality of debt has been deteriorating. With shorter term Equipment Trust Certificates and Conditional Sales Agreements, the drain on cash flow is greater. Leasing is becoming more prevalent and equipment pools are being increasingly utilized. The Congress recognized in the Rail Act of 1976 the need for a better rate of return in order for the railroads to obtain equity financing.[11/] The ICC was directed to, within 24 months, "develop reasonable standards and procedures for the establishment of revenue levels adequate to cover total operating expenses, plus a fair, reasonable, and economic profit or return (or both) on capital employed in the business" (Sec. 205) "and to provide special incentives in rate-making for capital investment of $1 million or more" (Sec. 206). The Act also establishes a Railroad Rehabilitation and Improvement Fund "to provide capital which is necessary to furnish financial assistance to railroads, for facilities maintenance, rehabilitation, improvements, and acquisitions, and such other financial needs as the Secretary of Transportation approves" (Sec. 502). The Fund applies both to "equipment" (locomotive and freight cars) and "facilities" (track, roadbed, terminal or yard facilities, repair shops, etc.). The net effect of this law should be to ease the pressure on the rail revenues for redeeming short-term debts while they build their tracks and roadbeds to a level of adequacy that permits the railroads to render better service at competitive prices. This legislative aid is considered essential but transitory toward getting the railroads back into the private capital market. It is generally agreed that if this plan doesn't work, the next step is more government involvement and eventually some form of nationalization.

In aviation, the investment in inflight equipment is on the order of $8.5 billion (compared with $1.2 for ground-support equipment -- other than airports). Investment in new aircraft in the next few years is expected to be very modest, however, as the carriers absorb their present excess capacity. The cargo-related investment that is undertaken will be narrow- and wide-bodied aircraft, containers, and related handling systems for the all-cargo carriers, and wide-bodied passenger aircraft with containerized support systems for the combination carriers.

The taxes (user charges) on passenger tickets and air waybills, collected by the airlines from the users, have supported a high percentage of the capital costs for airways and airports. The principal issue has been whether such taxes should also be applied to the cost of operating the airways and the air traffic control system operated by the federal government. The Administration won a narrow victory

with the passage of the Airport and Airway Development Act Amendments of 1976, which extended the user charges to maintenance of air navigation systems. This could open the way for further extensions of these charges for operating costs, and put a tighter sequence on capital spending in the industry.

Management

In the transportation industry, the general trend is toward fewer, larger carriers. There is also a tendency toward conglomerate ownership.

In the railroad sector, the bankruptcies in the Northeast resulted in the elimination of seven previous roads and the creation of the government-backed ConRail. There have also been a number of voluntary consolidations within the past decade.

The RRRR Act of 1976 will tend to further reduce the number of railroads. The principal provisions of the Act are:

1. New powers are conferred upon the Secreatry of Transportation to make a comprehensive study of the American railway system to measure the potential cost savings and improvements in service quality which could result from restructuring the railroads in the U.S. (Sec. 901).

2. Powers are given to the Secretary allowing him to develop and recommend mergers, consolidations, reorganizations, and other unification or coordination projects for consideration by interested parties (Sec. 401); and

3. The Interstate Commerce Commission is required to make its final decision on merger petitions within two years after the filing date (Sec. 403). Since there are over 70 Class I railroads today, and the Secretary of Transportation has called for a reduction to three or four nationwide rail systems, it is evident that there will be significant pressure on the railroads to merge and consolidate.

A major area of controversy exists between the rail industry and the regulators concerning conglomerate ownership. In recent years, many railroads have formed holding companies to engage in outside activities without being subject to ICC jurisdiction. The question at issue is whether these holding companies syphon off earnings from the railroad subsidiary or make the railroad more viable by generating higher earnings from outside activities than are obtainable through

railroad earnings. The question is far from being resolved; however, the expectations are that conglomerate ownership will continue. The importance for the shipping public is that railroad management is expected to pay closer attention to return on investment -- for specific commodities, on branch lines, and by equipment type.

In the trucking industry the trend is split. Among the largest carriers, the publicly held, general commodities carriers, there is a trend toward mergers and consolidations that are narrowing this field. Among the smaller carriers, however, there is a trend toward more specialized operations. Some of the major types of specialized carriers are Regular-Route General Commodities Carriers, Irregular Route Carriers, Heavy Haulers (primarily oversized or overweight), Bulk Carriers (tank and hopper types) and a new phenomonem, Container Carriers. Evidence indicates that incentives for individual carriers to become larger by consolidation and merger level off near the $1 million gross revenue range since economies of scale above that appear to diminish rapidly.

The overall impact of these actions has been to increase the total number of carriers certified by the ICC by over 15 percent since 1964. This could affect certain users of truck services by increasing the number of carriers they must utilize.

Conglomerate ownership has occurred in the motor carrier industry; however, it has not caused any serious problem. If anything, it has made the carriers involved stronger. It is not clear how widespread the phenomonem will become.

In the airline industry, the number of scheduled certificated route carriers has declined in recent years due to the difficulty of entry into the field, and mergers of weak carriers with stronger ones. The situation is relatively static at the present time. However, if the Administration's proposals on regulatory reform are adopted by Congress, entry requirements would be eased and the trend could be reversed, at least temporarily. Most observers do not expect favorable Congressional action on the more drastic measures such as entry requirements.

In other aspects of aviation, the all-cargo carriers and the supplemental carriers are relatively static -- both trying to survive during the aviation recession which started with the post-Vietnam decline and was accentuated with the 1973 fuel embargo and inflation. These carriers will experience difficult times in the next few years, providing another international crisis does not intervene to boost military cargos dramatically.

Part D

Technological Developments

No revolutionary technological developments are anticipated within the next five years, although there will be improvements in several areas. As Roger L. Merrill, of Battelle Memorial Institute states, "Any technology that will have an impact on transportation over the next five years is already well-known, is being brought to maturity and, perhaps being deployed."[12/] Support facilities and services -- communications, management information systems and automated terminal functions -- will be the major areas of change and improvement. There are several reasons for this: There is a basic need for improvements in these areas; much of the improvement potential has been achieved in the line-haul sector; and electronics applications are among the most dynamic in technological change.

Some of the specific technological improvement programs will be the development of automated onboard navigation systems, centralized vehicle control, computerized and telegraphic paperwork preparation and flows. Aircraft will continue to have the most advanced onboard navigation systems, although ocean vessels will become increasingly automated. Some strides could also be made in the rail and truck modes.

Truck operators will concentrate much of their efforts in the development of centralized dispatching and vehicle control, computerizing rating and tracing, and more sophisticated maintenance programs. These will all tie into total management information and control systems. However, these programs will be restricted to single company applications.

Railroads will concentrate on industrywide car routing and control systems to improve car utilization. Some individual companies will achieve improved automated shipper interface systems to include tracing, rating, invoicing and payment programs.

The terminal facilities of the various modes have been receiving increasing attention in recent years and this will continue. The railroad industry will increase the number of automated classification yards to speed the flow of cars through these facilities. The benefits are well recognized:

Lower cost.
Greater car utilization.
Shorter transit times.
Reduced cargo damage.

The principal new development in this area is a proposed, federally funded, demonstration intermodal terminal, but determination of its feasibility and implementation of a broad system of such facilities are not likely to be achieved in the next five to ten years.

Truck terminals are generally owned and operated by individual companies. These facilities are in varying degrees of mechanization and automation which are oriented to the traffic patterns of the company. Terminals of those carriers handling large volumes of small shipments will experience a continued trend toward mechanization of materials handling systems. Most of these devices (conveyors, towlines) are well recognized and in operation today. Consolidated terminals -- a centralized facility serving many carriers which would have common pickup and delivery fleets -- have run into problems. Touted as way to improve service and reduce costs in congested urban areas, it is unlikely that such facilities will be operational within the next five years. The concept suffers from lack of interest, lack of money, and a host of operational problems.

Air terminals will experience a continued trend toward containerized operations. Air terminals will be increasingly mechanized for handling small shipments.

Few dramatic changes in size, speed and capacity of transportation vehicles are likely in the next five to ten years.[13] Technologically, there are opportunities for improvements; however, these potential advances will be tempered by energy, environmental, and support facility constraints.

Incremental improvements in all modes are likely, primarily to (1) achieve greater productivity -- more utilization at lower costs -- out of the current state-of-the-art vehicles, (2) increase fuel efficiency, and (3) design propulsion systems that will meet environmental constraints.

Trucklines and airlines will concentrate significant efforts to improving environmental controls and improving engine efficiency. There is pressure from society to reduce pollution and energy consumption.

Normal commercial aircraft speed has leveled off at 600 m.p.h. for freight although carrying capacity can increase from 300,000 to 500,000 pounds. Supersonic speed is not expected to become economical in the near future.

Diesel engines will continue to be the predominant motive power for railroads and truckers. Horsepower ratings could increase slightly. Electricification of railroad engines will not become a major factor because they require an electrified roadbed, at a staggering cost. Gas turbine engines will not become economic for railroads due to higher cost and less fuel economy. The higher cost problem also exists in truck turbine engines, but lighter weight and competitiveness of overall fuel consumption could create a small market.[14]

There will be only minor increases in size of truck and rail carrying capacity due to right-of-way size and weight limitations. Train sizes will be stabilized as railroads strive to operate shorter, more frequent trains to improve customer service.

There are several constraints to technological development that are more institutional than technical. The major deterrent will be lack of capital, as "large-scale investments will be required simply to meet new social requirements without any increase in productivity."[15] Regulatory provisions that inhibit innovation will also be a constraining factor, as are the conflicting and impractical environmental and energy standards. In addition, labor restrictions and the fragmented structure of the industry will slow the pace of technological change.

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SECTION IV

FUTURE RAILROAD DEVELOPMENTS

A. National Policies

1. National defense. Railroads have been an important ingredient in national defense planning almost since their inception and their importance to the military continues today. In Fiscal 1974, the railroads handled almost four million tons of Defense Department (DOD) traffic with revenues in excess of $100 million. In addition, some types of traffic such as oversize equipment and vehicles are precluded from being feasibly shipped by other modes.

With the bankruptcy of many of the lines in the northeast quadrant of the United States and subsequent establishment of the United States Railway Association (USRA), the possibility of abandonment of segments of trackage became very real. To meet this threat, DOD has recently initiated a program entitled, "Railroads for National Defense (RND)." The ultimate goal of this program is to insure that defense requirements are included in the determination of the nation's total rail transportation needs. One aspect of this effort is to detect abandonments that could adversely affect the movement of defense materiel due to restricted weights and/or clearances over alternate routes.

The RND Program involves a joint effort between DOD and the Department of Transportation (DOT). The Military Traffic Management Command (MTMC) and the Federal Railroad Administration (FRA) are the contact agencies for the two departments. Although there is a policy agreement between the two agencies, little substantive progress has been made to date. One of the difficulties is the basic conflict in goals of the two agencies. FRA's mission is basically a rail network optimization planning function, while MTMC's goals are to insure a defense-oriented capability. FRA has a Rail Net Model that is essentially an information system of the nation's railroads. It contains such data as interchange points, whether a line is single or double track, and the type of signalling, but does not have track condition information. MTMC desires to identify defense needs which would be passed on to the FRA for use in the model. FRA, because of limitation of resources and other priorities, would prefer to make the data base available to MTMC for their use. The degree of success of this program is uncertain at the moment because of the obstacles facing it.

2. National transportation policy. The current government approach to policymaking for railroads is consistent with that directed to the other modes of transportation. This policy is spelled out by the Council of Economic Advisers (CEA) in its 1975 annual report. Specifically the CEA program includes "more freedom for carriers to raise and lower rates without regulatory interference, greater freedom to enter markets and to exit from uneconomic services, and a narrowing of the regulators; power to grant antitrust immunity."[1]

For the past several years, railroads have received increasing attention from Congress. First was the 1973 legislation that created the U.S. Railway Association to plan a successor to the bankrupt carriers in the Northeast that culminated in ConRail. Then came the passage of the Railroad Revitalization and Regulatory Reform Act of 1976 (RRRR),[2] which was signed by President Ford on February 5, 1976. This is landmark legislation that requires the planning of a national railroad network that is economically viable and makes changes in the economic regulatory processes.

Federal attention to the railroad industry is due primarily to their critical financial problems. Nine railroads have gone bankrupt in the last ten years, and during that time the return on net investment after taxes for all railroads has averaged less than three percent.

Federal financial assistance to the railroad industry has lagged behind that given to other transportation modes. Since 1970, however, funds to the industry have been speeded up. According to the General Accounting Office, (GAO), between July 1, 1969 and June 30, 1975, approximately $4 billion in direct federal assistance to the railroads has been authorized primarily in the form of grants, loans, and loan guarantees.[3] Of this amount, about $1.5 billion has been obligated. Since that time another $2.1 billion was authorized for ConRail. Most of the financial assistance has been directed to specific crisis situations in the midwest and northeast regions of the country. Little assistance has been provided to the remainder of the nation's railroad system.

The current federal government philosophy is to rely initially on a private enterprise approach to solve the railroad's financial problems. It is recognized, however, that,

> "special, short-term federal intervention and support are necessary to restore the operating financial viability and modernization of major portions of a vital industry in which nine firms have gone bankrupt in the last ten years and in which the industrywide rate of return on net investment after taxes has averaged only three percent over the last 11 years."[4]

The establishment of the United States Railway Association to develop a master plan for the northeast section of the United States and the chartering of ConRail to operate the system are examples of this policy. ConRail's charter creates a for-profit corporation in keeping with the private enterprise approach. However, recent controversies involving added initial government funding and stretching out of the target date for profitability cast doubt on whether this entity will attain a firm financial footing within the next five to ten years.

Under the RRRR Act, the DOT is required to plan and encourage a rational rail system and more efficient labor management practices. This embraces a reduction of excess rail trackage and unnecessary

services, and elimination of nonessential routes from the National Interstate Network. It also includes rehabilitating and modernizing the trackage remaining in the Interstate System. Reduction of wasteful labor practices and the encouragement of more profit conscious management practices are inherent in the plan.

The regulatory reform provisions include easier abandonment procedures to eliminate uneconomic rail trackage and more flexible pricing policies which will allow stronger competition within the railroad industry and between the railroads and other modes.

Other provisions eliminate state and local tax duplications.

B. Economic Trends

1. Management and ownership. The bankruptcies in the Northeast and the shaky financial position of certain other railroads have recently prompted increasing interest in consolidation and rationalization of the nationwide railroad system. The Secretary of Transportation has called for the establishment of three or four nationwide rail systems. There are over 70 Class I carriers in the country today. Some of the problems created by this large number of railroads are pointed out by one rail official who states, "The capacity and quality of service of other railroads act as a constraint on the ability of the individual railroad to preserve present markets and capture new business."[5/] This constraint covers many areas including equipment, transit time, pricing, and overall customer service.

Recent rail mergers have been both end-to-end and parallel, although, recently, parallel combinations have predominated. The more significant parallel mergers of late include the Pennsylvania-New York Central, Seaboard Airline-Atlantic Coast Line, Northern Pacific-Great Northern-Burlington, Chicago Northwestern-Chicago Great Western, and Chesapeake and Ohio-Baltimore and Ohio-Western Maryland. The Seaboard Coast Line-Louisville and Nashville association can be categorized as an end-to-end merger. However, except for two routes into Chicago, it is operated wholly within the southern region. The Norfolk and Western-Nickelplate-Wabash merger of about ten years ago established a system from the Atlantic Coast to Kansas City and was an end-to-end merger. However, none of these comes close to establishing a transcontinental system.

The regional carriers jealously guard and protect their traditional interline traffic and would have an extremely important voice in any proposed merger proceedings. The difficulties of achieving rationalization of the rail system are illustrated by the Rock Island case which involves most of the western roads. This case has been before the Interstate Commerce Commission for over ten years and it is no closer to resolution than it was when it started. If left to the ICC, it is doubtful that significant changes will occur in consolidation of individual rail systems within the next decade. DOT pressures could change that.

Railroads are currently severely restricted in their ability to own other modes of transportation. Several railroads do own and operate trucking companies; however, they are very severely limited in the scope of their operating authority and the trucking services must be related to rail movements. Railroads are precluded from owning airlines or water carriers with which they can or do compete for traffic.[6] There is one recent instance of railroad ownership of a barge line. The Southern Railway System (SRS) established a barge subsidiary to transport coal from origins on the Ohio River to a point on the Tennessee River where the coal is transloaded to SRS railcars for transit to electrical utilities in Alabama. This arrangement was authorized by the ICC only after a protracted struggle and is still criticized by various barge interests.

The probability of significant developments in multimodal ownership is remote. The concept of "transportation companies" as opposed to railroads, trucking companies, airlines, and water carriers, though supported by the railroads, is strongly opposed by the trucking industry, which believes such action would lead to the demise of independent trucking companies. Further, one rail official, who asked not to be quoted, offered that rail management has enough trouble running the railroad without being saddled with a truckline or water carrier.

2. Financial trends. The rail industry's share of the total transportation market has been declining over the past 20 years. Rail ton-miles as a percentage of total domestic freight ton-miles declined from 54 percent in 1947 to 33 percent in 1972. DOT projected the rail share will decline to approximately 30 percent in 1990.[7] More important, from the rail's viewpoint, the mode is losing its highest revenue traffic to the trucklines which is contributing to the decline of ton-mile revenues. Longer hauls or low-rated raw materials, due to increased geographic specialization of raw materials processing, is another contributing cause.

The railroad industry has a very difficult task facing it in attempting to obtain the financing which it needs over the next five to fifteen years. The capital and equity markets have been essentially closed to them because of inadequate earnings, stated Peter D. Horne, Vice President, Continental Illinois Bank & Trust Company of Chicago, at a recent conference on capital investment in transportation.

At this same conference, industry capital requirements were estimated at $4.5 billion per year by Mr. Thomas J. Lamphier, Executive Vice President, Burlington Northern Railroad. This amount is far above the $1.3 billion average of the past five years.

A recent study by Citibank of New York projected the railroads will have a cash shortage of $21 billion dollars between 1976 and 1985. It further stated that only $11.8 billion could be financed through Equipment Trust Certificates leaving a net shortfall of $1 billion per year. Equipment Trust Certificates will remain a disproportionately large portion of external financing over the next several years.

It is estimated that rail plant rationalization will be necessary to entice either government or private sources to make up the cash shortfall. Mergers, abandonments, and more flexible labor rules are among the changes necessary to attract additional capital. The burden will fall heaviest on the marginal carriers.

3. Capital investment. The railroads for years have had an inadequate return on investment which has contributed to their deteriorating physical plant. One expert states, "The overall return on the capital employed by the railroads has been far below the rates of return available on alternative investments of generally corresponding risk."[8/] Although the capital structure has changed little over the past decade, with equity capital holding about 60 percent, the quality of the debt capital has been deteriorating.

a. Equipment and rolling stock. There has been heavy emphasis recently on investment in rolling stock with approximately 75 percent of total rail investment over the past several years being directed to this area. This emphasis has increased the equipment portion to one half of the rail investment base which has historically been very heavily oriented toward fixed plant.

Due to the low profitability and poor credit rating of the railroads, the major source of financing for equipment has been Equipment Trust Certificates and Conditional Sales Contracts. These methods, which involve liens on the equipment, carry maturities of relatively short duration (10-15 years), and the equipment belongs to the creditor during the repayment cycle. This financing technique grew from 24 percent of long-term debt in 1960 to 36 percent in 1970 and is reflective of "the lender's unwillingness to extend credit to the railroads except on the security of assets which, in the event of default, can be readily moved from one railroad to another."[9/]

Necessity to amortize Equipment Trust Certificates over their approximate 15-year life constitutes a drain on the railroads' cash flow far in excess of more normal financing methods. In earlier periods, the railroads had sufficient credit standing to obtain long-term financing on their fixed permanent assets. Aside from the direct increase in financing cost, this trend increases cost of other debt and equity financing because it reduces the uncommitted assets of the industry. The rate of return for the industry will have to increase significantly for more conventional forms of financing to become more prevalent. Significant changes in this adverse situation are not expected in the near term future.

An additional adverse trend is the increase in leasing of equipment. These charges have grown to the extent that, in 1970, they constituted over 60 percent of railway operating income. This trend obviously cannot continue at the same rate as in the recent past. One solution which is already occurring is a growth in private car ownership. It is expected that more and more users of rail services

will find the railroads unable to provide adequate car supply and deem it necessary to invest in their own equipment.

Another alternative to the car shortage is the equipment pool. Trailer-Train, one example of this approach, is a subsidiary of the railroads which owns TOFC/COFC cars which are, in effect, leased to the individual roads on a per diem basis. This concept could be extended to other types of specialized cars, although for one type of specialized equipment -- tank cars -- it is viewed as the responsibility of the shipper to provide the equipment.

The equipment pool concept has been expanded to general purpose cars, as well. During a recent railcar supply crisis, potential alternative solutions were discussed by carriers, shippers, and government. Many of these included some form of government ownership. Ultimately, the railroads pursued for a private enterprise solution by forming a subsidiary to Trailer-Train called Rail-Box. This company operates on the same principle as Trailer-Train, only it owns general service, free-running boxcars.

The major disadvantage of this concept is that it relies on the credit standing and backing of the more financially viable carriers to secure the necessary financing of its fleet. Fleet expansion through this technique will be limited by the ability of these stronger roads to provide credit backing.

b. Roadbed and fixed plant. One of the major problems facing the railroad industry today is deferred maintenance and capital improvement expenditures. In this regard, the industry is caught in a vicious cycle. Since 1955, the rate of return for the industry has averaged 2.86 percent. Handicapped by large fixed expenses and the inability to generate adequate funds, the railroads have been forced to postpone maintenance. As the physical plant deteriorated and became obsolete, operating costs increased, further reducing profitability. Also, the deferrals caused service to suffer which caused a loss of traffic and, hence, revenue which added to the erosion of industry profits.

A basic problem hampering elimination of deferred maintenace is the uncertainty over the magnitude of the deferrals. A recent GAO study concluded:

> "- No comprehensive studies existed which objectively and quantitatively described the existing condition of track on a nationwide basis.
>
> - None of the available cost estimates to repair or replace deteriorated track provides a complete, reliable assessment of the long-term financial resources that might be required to rehabilitate the Nation's railroad system."10/

Cost estimates range from $3.7 billion for the bankrupt railroads in the Northeast to $13.7 billion for the entire industry. The GAO Report stated that, although the Northeast Railroad study conducted by the USRA was the most comprehensive, there is no valid method for extrapolating the results to the entire railroad system. GAO also believes the estimate by the FRA of $9 billion for the entire system is as objective and reasonably valid as any estimate of deferred maintenance.[11]

However, GAO states that even this study: "is not capable of answering, with any degree of confidence, where deferred maintenance exists; to what degree; on what systems; whether it is a mainline, branch or yard track; where some degree of deterioration might be justified; or where not only rehabilitation but actual upgrading may be necessary."[12]

It is quite clear that federal assistance to the railroad industry is necessary and will be forthcoming. "Only the amounts required and the forms and sources of funding appear to be in question."[13] One government official believes the railroads cannot generate enough revenue to cover this expenditure on their own. To do so they would have to raise their rates to such a level that they would lose much of the traffic they currently haul. Another government expert believes that such assistance will probably start as soft (unsecured) loans and end up with grants to the bankrupt railroads. There could be a system of rationalization of mainline trackage, although there will probably not be outright abandonment of parallel lines. Some of the current duplication of mainline trackage will be overcome by downgrading current trunk lines to secondary line status. These secondary lines would be undermaintained or not maintained to as high a standard as the main line trackage.

The RRRR Act provides $2.1 billion for ConRail, much of which will be directed toward maintenance and capital improvement purposes. Also provided is $200 million specifically for electrification of the ConRail line between Pittsburgh and Harrisburg, Pennsylvania. The Act further allocates $600 million for maintenance and capital improvement items for railroads in any part of the country during the next two years. It is expected that Congress will provide additional funding beyond the time frame.

4. Operating expenses.

a. Labor costs and productivity. Labor costs are an important part of the railroad industry's cost structure. In recent years it has averaged about 50 percent of total railway and operating expense.[14] This trend is expected to continue (Schedule C-I, Forecast of Rail Labor Costs). Wage costs have been increasing higher than those for industries in general without offsetting productivity gains. From 1964 to 1974 the average annual compensation per employee rose from $7,000 to over $14,000, while revenue ton-miles rose only 35 percent from 658 billion to 850 billion.[15] Railroad management has countered this adverse

trend with a 20 percent reduction in the number of employees; however, union work rules significantly inhibit attempts to increase the productivity of the labor force. Further, most merger agreements include provisions for job protection.

One railroad industry source believes restrictive labor agreements are the root cause of most of the industry's problems. For example, labor contracts with the operating unions limit management's ability to reduce crew sizes, thus creating a tendency to operate fewer and longer trains which necessitates more switching, and contributes to longer transit times and unreliable service. Though the labor issue is a particularly sensitive area and one that has been receiving increasing attention from railroad management, the Task Force on Railroad Productivity found that labor relations have been "quite constructive and peaceful in recent years."[16/] The settlement of the fireman issue and the consolidation of several operating unions into the United Transportation Union (UTU) are viewed as positive steps in improved labor relations. A more recent example of the improved atmosphere was the settlement of the 1975 labor contracts without a strike.

Discussions with officials in the industry and in government indicate a prevailing view that significant gains will be made in improving the efficiency of labor input by the end of the decade. The Railroad Task Force acknowledged that it is extremely difficult to project potential savings; however, they said "the cost equivalent of restrictive work rules in terms of lost efficiency is estimated to be on the order of $500 million to $1 billion per year."[17/]

b. Fuel. Prior to 1974, fuel costs averaged approximately three to four percent of total railway expenses. As a result of the Arab Oil embargo and the resulting price increases, railroad fuel costs have jumped to approximately seven percent of total expenses totalling over $1 billion per year.[18/] By 1982, fuel costs are expected to increase to over $2 billion per year and consume roughly ten percent of railroad costs (Schedule D-I, Forecast of Rail Fuel Costs).

However, modal shifts are expected to be minimal with increased fuel prices, mainly because existing cost and service differentials among the modes are large enough so that marginal changes in relative costs, due to the differential impact of increased fuel prices, are not expected to have any significant effect on modal choice for most freight. There could be some increased use of truck/rail intermodal containerization. Possibly there could be some small shifting of truck freight to rail which would be more than offset by a shift of rail freight to a water carrier.

c. Operating subsidies. As previously noted, the railroads have only recently become recipients of government aid to any appreciable extent. For Fiscal Years 1970 to 1975, according to GAO figures, $936 million of federal aid was allocated for operating capital and an additional $128 million, for repair and rehabilitation. Of these amounts, $100 million went to the Penn Central and $6 million to the Central New Jersey for meeting payroll and other operating

expenses. The bulk of the rest is estimated to have gone to Amtrak for passenger services.[19]

It is anticipated that amounts expended and appropriated for operating subsidies will dramatically increase in the years to come. Much of this will be directed to the northeast railroads and, particularly, ConRail. The funds will be used for repair and rehabilitation of roadbed and for maintenance of uneconomic branch lines. $210 million has been appropriated under the Regional Rail Reorganization Act of 1973 to the northeast railroads to meet operating expenses, and an additional $24 million has been appropriated for maintenance and improvement funds for these carriers.

The RRRR Act provides for an appropriation of $600 million for rehabilitation and improvement for the industry and an additional $2 billion specifically for ConRail.[20]

d. Discriminatory property taxation. The Association of American Railroads (AAR) reports that railroads pay property and other taxes in lieu of property taxes to state, county, and municipal governments in excess of $400 million per year. It further estimates that approximately $130 million of this figure is due to discriminatory property taxation. A provision prohibiting discriminatory taxation with certain exceptions was included in the 1976 Rail Bill.

Section 306 of the RRRR Act prohibits unreasonable and discriminatory taxation of railroad property by any State or subdivision thereof.[21] The provision does not become effective until 1979 and does not become operative unless the assessed value of railroad property to true market value exceeds five percent of the assessed value to true market value of all other commercial and industrial property in the same assessment district. It is, therefore, unclear at this time what, if any, favorable impact this provision will have on the industry.

C. Regulatory Trends

1. Economic regulations.

a. Inflexibility of pricing. This is one of the major problems facing the rail industry today. The railroads are victims of their monopolistic position of several decades ago when precedent setting pricing formulas were commonplace. There are strictly observed relationships between and among commodities and for distances and geographic territories that are still in force today. Many of these pricing formulas are based on value of service considerations which employ cross-subsidization of lower valued commodities. The railroads have found themselves losing much of their higher rated commodities with the lower priced commodities remaining on the railroads. Attempts to increase rates on these lower rated commodities, which are mainly raw materials and semifinished products, have been met with strong resistance from shippers. It is anticipated, however, that there will be increases in the rate levels of these low-rated commodities. The

Interstate Commerce Commission is expected in the near future to release the results of its general investigation of railroad rate levels -- Ex Parte 270.

Also contributing to inflexible pricing are the rate bureaus. These regional rate-making associations which were authorized by Section 5a of the Interstate Commerce Act (Reed Bulwinkle Act, 1947) help establish and publish rates for the individual railroads.[22] Rate bureaus have come in for increasing criticism in recent years and various government agencies and bodies have been investigating them. The Interstate Commerce Commission conducted a rate bureau investigation (Ex Parte 297) which recommended reforms in rate bureau operations. The Department of Transportation had originally recommended the elimination of rate bureaus but more recently has recommended drastically reducing the power of these rate-making organizations. These proposals have been fought by the bureaus and individual railroads along with motor carriers and their associations. The next result was that the RRRR Act reduced the powers of rate bureaus somewhat to allow some pricing flexibility for the railroads. Specifically, the Act prohibits rate bureau discussion or participation in single line rates, limits discussion or agreement on joint line rates to carriers who can participate in the movement, and prohibits rate bureau protest of any rate proposals by independent action.

An additional constraint to pricing involves the railroads' competitive stance regarding other modes of transportation. The so-called "fully allocated" versus "variable costing" concept has generated much controversy in transportation circles. The Interstate Commerce Commission has historically held that railroads cannot set prices at the variable cost level. Their authority is vested in the National Transportation Policy of the Act which provides for "fair and impartial regulation of all modes of transportation subject to the provisions of this Act, so administered as to recognize and preserve the inherent advantages of each."[23] It is not expected there will be much change in the interpretation of this provision until it is further clarified by the Congress.

b. Regulatory lag. The problem called regulatory lag stems largely from railroad pricing procedures and usually involves general increase proposals. General increase proposals are handled on an industrywide basis, although there are some regional variations maintained. The initial prerequisite is to develop a consensus among the railroad executives which can consume many months. The next step is a filing with the Interstate Commerce Commission for permission to publish an increase. This step can take two to three months depending on conditions. The final step is the publication of the actual increases which are subject to protest by shippers and other interests. The rates can be suspended for investigation for a maximum of a seven-month period by the Interstate Commerce Commission.

The end-result of this multistep process is that there has been a serious lag between the time that costs are incurred and the time that rates are increased to recoup those costs. In recognition

of this problem, there have been various proposals in Congress to provide a speedier process for receipt of cost induced rate increases. The 1976 Rail Act includes a seven percent no-suspend zone whereby a railroad can speedily receive the increases within this zone.[24] The Act also sets maximum time limits on ICC consideration of rate proposals. This will have the effect of reducing future rail revenue increase needs because railroads will be receiving earlier benefit of increased revenues. The impact of this change is difficult to measure because it is too early to determine the extent to which the railroads will take advantage of it.

c. Abandonment. Entry and exit are regulated by the Interstate Commerce Commission. Currently, the major problem for the railroad is exit. Due to the decline in rail traffic and geographic shifts in industry, many branch and feeder lines have become uneconomical to maintain and operate. Historically, railroads had to apply to the ICC for permission to abandon these segments. Such petitions were subject to protest by interested or affected shippers and/or local municipalities. This protest procedure had the effects of delaying or precluding the abandonment of many branch lines. With the recent fuel situation, there has been increased emphasis by local interests on maintaining these light-density lines. Recognizing this problem, which is particularly critical in the Northeast, the Rail Reorganization Act of 1973 has a provision for maintaining these lines on a joint federal, state subsidy basis. The 1976 Rail Act contains a provision authorizing:

> "the Secretary of Transportation to provide financial assistance to the States for rail freight assistance programs that are designed to cover the costs of 1) Rail service continuation payments; 2) Purchasing a line of railroad or rail properties for 'rail banking'; 3) Rehabilitating and improving a rail line; and 4) Reducing the cost of lost rail service in a less expensive way than continued rail service."[25]

The federal share is 100 percent for the first year and decreases to 70 percent in the fourth and fifth years. $360 million has been authorized for federal participation in this program.

This provision should aid the rail burden of absorbing the costs of money losing branch lines. The AAR has estimated the industry cost of maintaining uneconomic branch lines at approximately $130 million per year.

d. Section 22 rates. Section 22 of the Interstate Commerce Act authorizes railroads and other common carriers to provide transportation services for the government at reduced rates. These rates have been attacked over the years as being unduly discriminatory against commercial shippers. Several years ago, there were various proposals before Congress to eliminate Section 22 rates to remove the burden on commercial traffic. As a result of this Congressional interest, the General Accounting Office conducted an analysis of Section 22 rates for DOD traffic. Two reports were issued (one for rail rates and one for truck rates).[26] Both studies showed significant savings to the DOD by using Section 22 rates versus commercial tariffs.

The study further concluded, "...the overall charges under Section 22 were not only compensatory but also well above the carrier costs."[27]

Discussions with the Military Traffic Management Command (MTMC) indicated there is an attempt on their part to instill some rationale in the Section 22 rate negotiations with carriers. This rationale could take the form of distance or scale relationships. It was emphasized, however, that MTMC has no control over carrier initiated rates.

It is believed that the fervor over Section 22 rates has abated, at least for the time being. There is no evidence that any steps will be undertaken in the near future to eliminate Section 22 rates.[28]

2. Safety regulations. Railroads have not been greatly hampered by safety regulations except as they are tied to labor requirements. One problem has been almost totally resolved and that is the full crew laws that were in effect in many states. These laws specifying the minimum number of crewmen that must be on a train had cost the railroads significant amounts of money because the minimums were in excess of the crew sizes that were used in adjacent states. Thus, the railroads had to add crewmen to the trains when travelling through the involved states. One possible area of conflict in the future could be the whole safety issue with regard to establishment of smaller crews to make economical more frequent trains of shorter length to increase the competitiveness of the railroads. This issue has not been addressed by either railroads or the union as of this date.

Another potential safety problem could arise in the transporting of hazardous materials. Because of the deteriorated condition of a significant portion of the railroad bed, there has been an increasing number of derailments. Of particular importance are those derailments that occur in urban areas with trains that are carrying hazardous materials. This has become a health and safety issue and should this trend continue, new legislation or restrictions could be enacted that could add to the railroads' operating cost burdens.

3. Environmental regulations. The railroads have been relatively immune to the controversy in this area. They are required to file environmental impact statements with any increase in or reduction in rates or services and there is a need for such a filing on abandonment proceedings. However, this requirement has not created an undue burden upon the railroads. It is not expected that the future will increase this burden signficantly.

4. Energy allocation and price regulations. The railroads would be affected like other modes of transportation by any allocation of petroleum fuel. It would adversely affect their service and could affect their competitive position. During the fuel shortages in 1974, the railroads had to reduce the number of trains which led to deteriorating service and reduced car utilization. Price regulation would have a favorable impact and would probably affect other modes in the same general way.

D. Technology Trends

The major technological improvements in the railroad industry will occur in the operational and communications areas. Developments in equipment and support facilities will be oriented toward improving efficiency with existing technology.

1. Rolling stock. Diesel engines are the predominant type of propulsion today although there is some experimentation with gas turbines. Electric engines are used on electrified portions of track which are mainly on the heavy-density lines along the East Coast. Diesels are expected to be the predominant propulsion method for the near-term future. Most line-haul engines today are in the 5,000 to 6,000 horsepower category. Projections indicate the technical feasibility of engines up to 15,000 horsepower.

Gas turbine engines will not become a major factor in railroad operations in the short run as they suffer two major disadvantages: (1) inferiority to the diesel in fuel economy and (2) a higher initial cost. "On the other hand, the turbine's advantages of reduced weight, compactness, and ability to burn natural gas are not very significant in railroad applications."29/

The need for additional horsepower is contingent upon the train weight that must be pulled and the speed of operation. It is expected that train sizes will not increase and could decrease as railroads strive to provide better service in competition with trucks. The speed of trains is restricted by the condition of the roadbed. It is anticipated that improvements in roadbed will be spread out over the next five to ten years; therefore, an appreciable need is not seen for increased horsepower in the foreseeable future. Figure IV-1, Maximum Diesel Locomotive Horsepower, highlights the past developments and future trends.

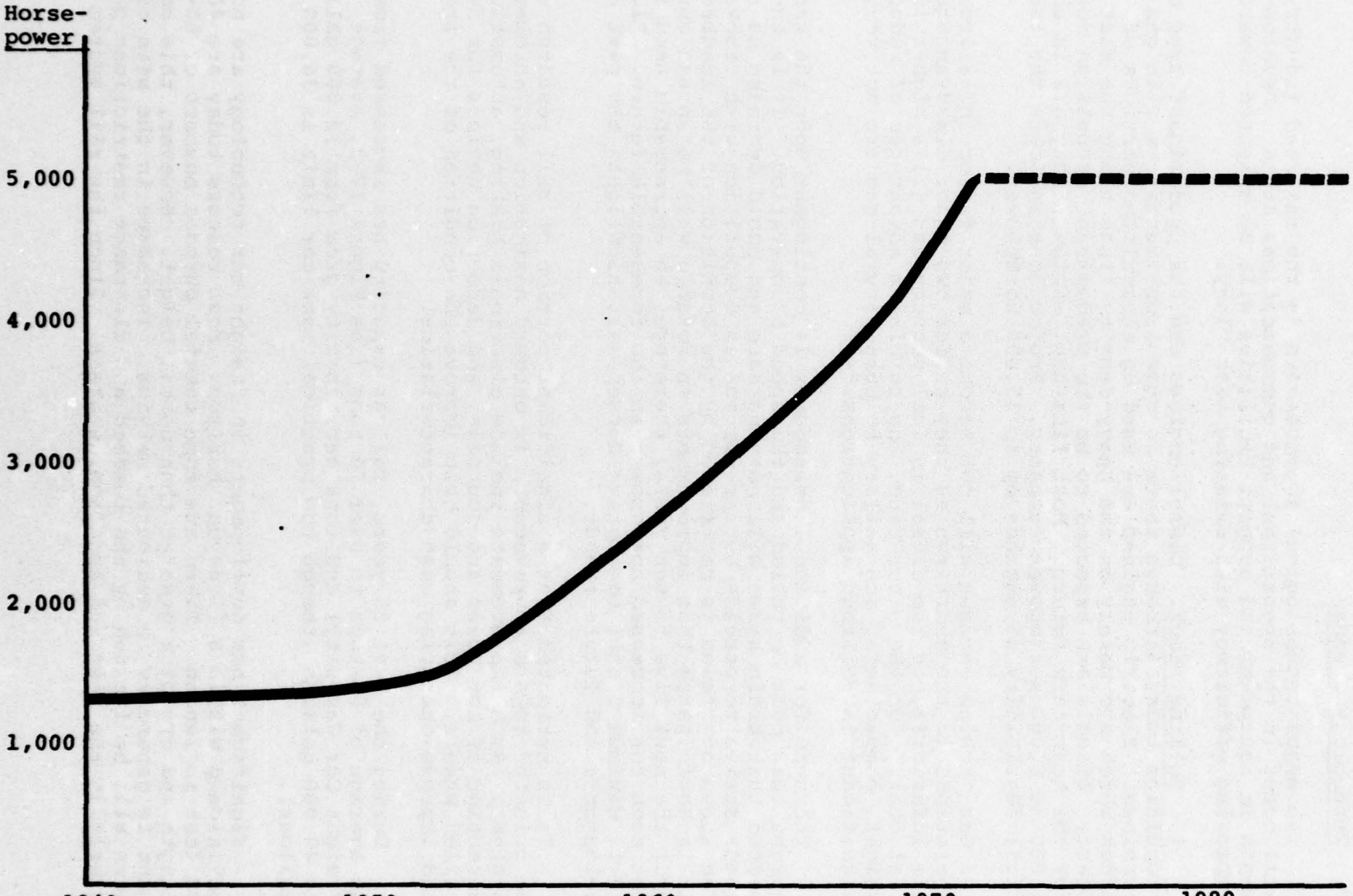
It is estimated that a significant portion of rail research will be oriented toward improvements in onboard navigation and automation systems. Such improvements include electronic braking, automatic detection of hot boxes and journals, and detection devices for derailed wheels. This should help improve the condition of the freight and improve operating cost characteristics.

During the last 25 years, railcar capacity has increased from an average of 52 tons to over 70 tons (see Figure IV-2, Average Freight Car Capacity) and tank car capacity grew from 10,000 gallons to 48,000 gallons (though the practical tank car limit is 30,000 gallons).

Significant new developments in freight car technology are not envisioned within a five-year horizon. Most boxcars today are 40 or 50 feet in length. There are some special purpose boxcars of 60-foot length and are of a greater than normal height. However, this equipment is generally in dedicated service. Increases in the size of cars will be limited by the roadbed and clearance restrictions particularly in the East and Appalachian areas. Since the rail system is

Figure IV-1

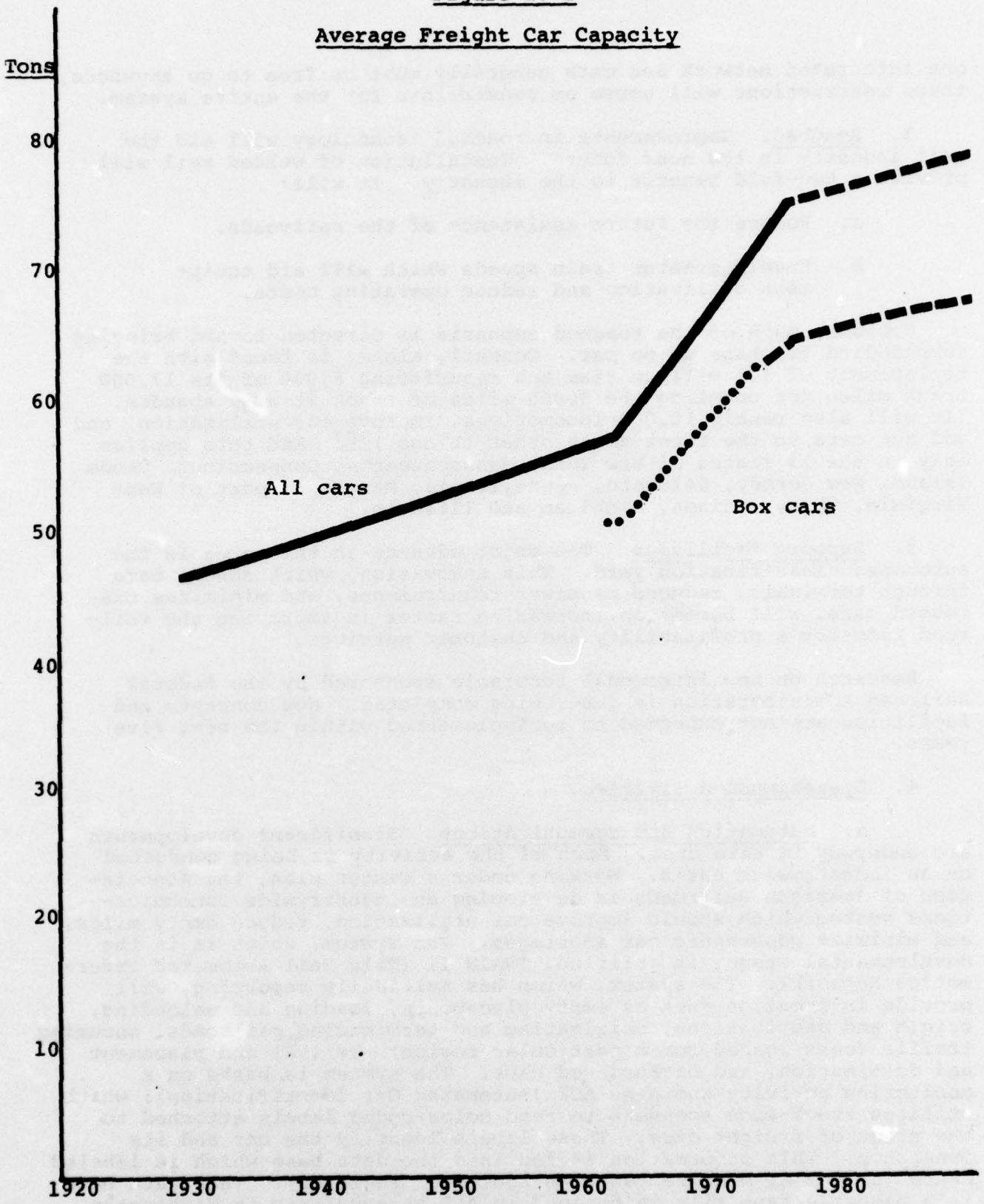
Maximum Diesel Locomotive Horsepower



Source: Electromotive Division, General Motors Locomotive and Car Division, General Electric Company

Figure IV-2

Average Freight Car Capacity



Source: Association of American Railroads

one integrated network and cars generally must be free to go anywhere, these restrictions will serve as constraints for the entire system.

2. Roadbed. Improvements in roadbed technology will aid the rail industry in the near future. Installation of welded rail will provide a two-fold benefit to the industry. It will:

a. Reduce the future assistance of the railroads.

b. Enable greater train speeds which will aid equipment utilization and reduce operating costs.

However, much of the roadbed emphasis is directed toward bringing substandard trackage up to par. ConRail, alone, is faced with the replacement of 4.1 million ties and resurfacing 6,800 of its 17,000 track miles not counting the 3,000 miles of track it will abandon. (It will also repair 12,000 locomotives, improve car utilization, and add new cars to the fleet among other things.)[30/] And this applies only in the 13 states of New York, Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware, Pennsylvania, Maryland, part of West Virginia, Ohio, Indiana, Michigan and Illinois.

3. Support facilities. The major advance in this area is the automated classification yard. This innovation, which speeds cars through terminals, reduces manpower requirements, and minimizes misrouted cars, will become an increasing factor in improving the railroad industry's profitability and customer services.

Research on new intermodal terminals sponsored by the Federal Railroad Administration is just being completed. New concepts and facilities are not expected to be implemented within the next five years.

4. Operational activities.

a. Automation and communications. Significant developments are underway in this area. Much of the activity is being conducted on an industrywide basis. Working under a master plan, the Association of American Railroads is developing an industrywide communications system which should improve car utilization, reduce empty miles, and minimize geographic car shortages. The system, which is in the developmental stage, is entitled, TRAIN II (Tele Rail Automated Information Network). The system, which has multidaily reporting, will provide information such as empty placements, loading and unloading, origin and destinations, originating and terminating railroads, oncoming traffic (cars loaded for a particular region), arrival and placement and destination, and backordered cars. The system is based on a monitoring activity known as ACI (Automated Car Identification); which utilizes track-side scanners to read color-coded labels attached to the sides of freight cars. These labels identify the car and its ownership. This information is fed into the data base which is labeled UMLER (Universal Machine Language Equipment Register). This data base is a magnetic tape file maintained in AAR headquarters in Washington, which contains a register of all railroad equipment translated into machine language for easy use by the computer.

This industry system will be limited by the capabilities of the individual railroad systems for moving cars on their own lines and through their individual railroad terminals and classification yards and the extent of participation by individual roads in the ACI Program. There are varying degrees of sophistication and progress by individual carriers.

The use of automation for onrail systems, such as electronic braking, detection of hot boxes, and derailed wheels will see only minor progress within the short-term future.

The use of automation and communications to improve shipper interface will see some advances in this decade. Even today, some large shippers have computer compatibility with rail systems. These interfaces are used to locate cars, monitor transit times, and plan shipment loading. This advance will be limited to larger shippers that have the volume of cars to warrant the expense and time required to implement these systems.

b. Operating improvements. The future will see some increase in the use of run-through or preblocked trains which bypass terminals and classification yards. These will improve the operating costs and service aspects of railroad operations.

There will be an increase in the use of unit trains although this technique will be limited mainly to single line operations of bulk product commodities such as coal and grain.

The use of carpools has grown in the past couple of years and could see some growth in the future. Historically, the trend started with the establishment of Trailer-Train, Incorporated, a subsidiary of the railroad. This company owns and leases on a per diem basis, specialized flatcars for carrying trailers and containers. Due to a shortage in general service boxcars, a subsidiary of Trailer-Train, Rail-Box, was recently established to own and operate a pool of 10,000 boxcars dedicated to the same purposes as the piggyback cars. Advantages of this system include greater car utilization, and ease in financing. These cars were financed on the credit rating of the stronger railroads. Retirement of the debt is through per diem payments by the individual railroads on whose lines the cars travel.

c. TOFC/COFC. Containerization through Trailer-on-Flatcar and Container-on-Flatcar applications is seen by some experts as the salvation of the rail industry. When the railroads first got into piggyback traffic, it was done on an ad hoc basis with existing facilities and lack of coordinated through movement. Even today there is very little coordinated interchange of piggyback traffic. The Task Force on Railroad Productivity for one advocates this approach for the railroads if they are to survive as vital enterprises.[31] The Federal Railroad Administration has research underway to develop data and recommendations on:

(1) The comparative advantages of trailer versus containers.

(2) Advanced terminal designs.

(3) Location of intermodal terminals.

(4) A design of lightweight, sophisticated trailer or container cars.

Supporting this research effort, the Association of American Railroads views the solutions to increasing the amount of piggyback traffic as:

(1) Utilizing dedicated equipment to achieve better utilization.

(2) Achieving balanced traffic flows.

(3) Obtaining savings in labor costs by running through trains.

(4) Designing more efficient terminals.[32/]

It is projected, however, that the major improvements in this area will not be realized much before a ten-year horizon because of the many complex factors involved and the delays in implementing recommendations of current ongoing studies.

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SECTION V

FUTURE MOTOR CARRIER DEVELOPMENTS

A. National Policies

Department of Transportation (DOT) policy states, "Interstate commerce and national security require that a high level of performance be maintained on our nation's major highway systems."[1] This contemplates completion of the Interstate Highway System, modernization of older segments of the Interstate System, and a review of the needs of other highway systems, particularly in urban areas.

1. Defense policies. The importance of the highway system is recognized by the Defense Department (DOD) through its program, Highways for National Defense (HND). This program, which has been in operation since World War II, exists through statutory authority. Specifically, the Secretary of Transportation is empowered to take certain actions concerning public highway construction and maintenance when certifications of their defense importance are issued by the Secretary of Defense.

The program has three major directions: The first pertains to the highway system. DOD provides DOT with requirements which warrant inclusion into development of U.S. highway systems, and their standards and specifications. DOD has also participated in location of routes for the Interstate System. The second area involved DOD participation with the states to insure appropriate and safe use of public highways that are defense unique, i.e., military convoys or overweight and oversize pieces of defense equipment. The third area pertains to defense access roads. This aspect enables the military services to provide financing for public highway improvements in order to satisfy special defense requirements. The deployment of weapons systems or bases, such as Safeguard or Trident, account for the bulk of expenditures under this phase of the program.

The HND Program has been successful in accomplishing its mission and is expected to continue. There is no evidence that it will deviate from its historic roadway orientation.

2. Transportation policies. The two principal aspects of national transportation policy relating to highways are (1) promotion of the Interstate Highway System and its related Highway Trust Fund, and (2) the regulations affecting truck transportation -- economic, safety, and environmental.

The Interstate Highway Program, created in 1956, is now in its final phase of completion (about 86 percent at 90 percent federal highway trust funding). It has represented 60 percent to 70 percent of all federal financial programs for transportation (and over 1 percent of GNP) during its existence. This is contrasted with an average of about 20 percent for air, 12 percent for water, and 4 percent in recent years for mass transit. A four cent a gallon federal gasoline tax has

been the principal source of funds for this program. Since the Interstate is nearing completion, funding for primary and secondary systems is now up to 70 percent federal and 30 percent state and, after June 30, 1976, the monies will be channeled to a newly defined system of primary and secondary roads based upon a functional classification of highways.

There are no federal R&D programs affecting trucking, other than related to highway construction. The federal regulation of trucking is primarily in the economic and safety fields. Under the Interstate Commerce Act, most for-hire trucking is regulated as to entry, rates, routes, and exit. Currently, the Administration has proposed to the Congress that these regulations be relaxed and that the regulatory processes be speeded up. Although strongly opposed by the trucking industry, these proposals are intended to make the industry more competitive and benefit the public. Some moderate changes may take place in the next five years.

Another national transportation policy is to encourage truck/rail, and truck/air/rail/ship intermodality while protecting the inherent advantage of each mode. There is much to be done in this area and, for the most part, the potential of intermodal services remains unrealized. The exploitation of the inherent efficiencies of modes working in combination has been inhibited by an array of physical and institutional barriers, such as interchange of equipment, lack of true intermodal terminals, conflicting regulatory objectives and lack of multimodal ownership. It is believed that these barriers are significant enough that only minimal progress will be made in this area in the next five years.

B. Economic Trends

1. Management and ownership. There has been rapid growth in commercial trucking as evidenced by the improvement in the percentage of total ton-miles achieved by the sector. In 1947, for-hire trucking accounted for under four percent of total ton-miles; by 1972, this had grown to 11 percent.[2/]

The total number of motor carriers subject to ICC jurisdiction has increased approximately 15 percent since 1964 (from almost 14,000 to just over 16,000). However, there has been a reduction in the number of the large carriers that perform a variety of types of services. Mergers, purchases, and bankruptcies have all contributed to this trend. Many of the carriers in this group are in the category of Regular-Route General Commodities Carriers, which operate over fixed routes between fixed termini. More and more of these carriers are tending to specialize in less-than-truckload traffic as carriers with lower cost structures attract much of the truckload business away from this group. These specialized carriers do not have the burden of maintaining an extensive system of terminals, maintenance facilities, and sales offices. This group of specialized carriers, also called Irregular Route Carriers, comprises a group of companies, many of them relatively new, that specialize primarily in truckload-type traffic.

They either concentrate on a specific commodity or group of commodities or cover a broader spectrum of products. These carriers have been providing the keenest competition for the railroads. These carriers:

"(1) specialize in handling specific commodities (paper and paper products, building materials, refrigerated food products, steel, etc.);

(2) handle truckload traffic;

(3) provide direct service to all points authorized (no interlining);

(4) have no terminal operations;

(5) may serve all authorized points in a state or region;

(6) rely on owner-operators almost exclusively;

(7) publish their own individual line tariffs;

(8) use specific point-to-point commodity rates based primarily on actual highway miles;

(9) provide an unlimited number of stopoffs where they have been established;

(10) provide service on an unscheduled basis."[3/]

Whereas, the above carriers generally use regular van-type equipment, there are several other types of specialized carriers that utilize specialized equipment.

Among these are Heavy Haulers which are primarily geared to products that are oversized or overweight and generally utilize flatbed for open-top trailers. Bulk Carriers operate tank or hopper-type equipment and usually have specific commodity authorities. These carriers usually carry only truckload quantities. Container Carriers are a new type of carrier which consists of a few companies that specialize in transporting containers (mainly steamship owned) between U.S. ports and inland origins and destinations.

It is expected that this trend to specialization will continue to grow in the next few years. Since the economies of scale are not too great in the trucking industry, there is no pressing need for the carrier to become larger for the sake of achieving operating economies. The trend could increase the number of companies with which some shippers must patronize in the not-too-distance future.

Several motor carriers have recently acquired air freight forwarder subsidiaries. This concept has recently been upheld by court ruling and is expected as a trend it will continue. The institutional

barriers are such that there is expected to be little other significant change in intermodal ownership.

2. Industry financial trends. The trucking industry is expected to grow at a faster rate than other modes of transportation, which is reflective of the advantages offered by the trucking industry over the other modes in speed, flexibility, reliability and convenience.

As one financial analyst states:

> "Continued shifts of industry away from the metropolitan rail centers and airports and further expansion of the Interstate Highway System should boost the demand for motor carrier service. Despite the threat of competition from railroads, whose unit costs of piggyback service are cheaper for bulk shipments over all distances, the actual competition should be quite limited because of the superior service offered by truck transportation. The motor carrier can provide speedy door-to-door and claim-free service, particularly for shipping high-value items over short and medium distances. It is expected the share of motor carrier service in the total freight market will continue to rise in the future."[4]

Projections by the Department of Transportation indicate the trucking industry's share of total ton-miles will grow from its current 11 percent to 13.6 percent by 1990.[5] Revenues, however, are projected to grow at a slower rate than ton-miles, as a result of the increase in the share of lower valued and lower rated freight which the industry will be transporting.

3. Capital investment. Capital investment in equipment, terminal facilities, and cargo handling equipment is exclusively from private capital in the motor carrier industry. The majority of this investment is in the form of equity capital. The proportion of debt capital declined from just under 37 percent in 1968 to approximately 30 percent in 1972. It is contended in a study sponsored by the Regular Common Carrier Conference of the American Trucking Associations that even though this is a favorable trend, the debt level is higher than that of unregulated industries.[6] The implication in this study is that the leverage created by a higher debt level increases the rate of return on investment needed to attract capital. The current rate of return on equity is in the neighborhood of 17 percent. There is no conclusive evidence that this debt-equity ratio accompanied by the existing ROI are inhibiting the replacement or expansion of equipment or facilities. It is not clear at this time whether this debt-equity ratio trend will continue into the future.

Right-of-way capital is provided by gasoline taxes and other fees which are paid into the Highway Trust Fund. This fund is used to finance new highway construction and rehabilitation. Commercial trucking companies, private truckers, and automobiles alike pay into this fund, though in differing amounts. There has been some controversy over whether the heavy-duty trucks pay their fair share of cost for highway construction, given the benefit received and the wear and

tear to the highways that they cause.[7] The issues include not only the relative sums paid but the method in measuring the relative contributions of each of the types of highway users. Given the lack of specific evidence and the power of the trucking interests, it is expected that no major changes in highway user fees will be implemented within the foreseeable future.

4. Operating expenses.

a. Labor. Labor is a significant cost to the trucking industry, constituting almost 60 percent of total costs. No major changes in this relationship are anticipated in the next several years. This is illustrated in Schedule C-II, Forecast of Motor Carrier Labor Costs. The most recent nationwide labor contract negotiated between the trucking industry and the Teamsters Union became effective April 1, 1976. It calls for approximately a 30 percent increase over three years.

It is doubtful that productivity gains will be sufficient to offset wage cost increases. Recent events will have a counteracting impact on productivity improvement. The liberalization of weight limitations will add productive capabilities, while the reduction in the speed limit to 55 m.p.h. will have a negative impact. It is expected that labor costs will be the major concern of the motor carrier industry over the next several years.

b. Fuel costs. Fuel costs averaged four to five percent of total costs in the pre-1973 time frame. Significant price increases in the cost of fuel during the oil embargo have raised this percentage to approximately nine to ten percent today. This level is expected to increase slightly in the near term future to between 11 and 12 percent. Schedule D-II, Forecast of Motor Carrier Fuel Costs, shows this trend. The increased cost is expected to encourage economics in vehicle design and engine efficiency. In addition, improvements in operating efficiencies will also be sought.

Modal shifts of freight are expected to be smaller as a result of this continued trend of high fuel cost. Some tonnage could be lost to the railroads due to relative fuel efficiencies, although all or part of this loss could be offset by shifts from the air cargo carriers. Increased coordination between truckers and railroads will be encouraged in certain situations.

C. Regulatory Trends

1. Economic regulations. Current regulatory reform efforts are concentrated on rate bureaus, entry, regulatory lag, and mergers. The success of these Administration-backed proposals is cloudy at the current time. Election year politics and the possibility of a change in administrations add to the uncertainty.

a. Rate bureaus. Rate bureaus, the price fixing associations of motor carriers, are currently under attack by the Administration.

These rate-making groups, which are authorized by Section 5a of the Interstate Commerce Act, are accused of inhibiting competition, protecting the high cost carriers, promoting inflexible pricing, and limiting productivity gains. Proposed legislation currently before the Congress would limit the power of rate bureaus. Specifically, it would prohibit discussions or agreements of rate matters by carriers not participating in that movement whether single or joint line. It also would preclude joint protest action of rates and set a maximum time for consideration of proposals.

However, given the sensitivity of the issue and the power of the trucking industry, it is expected that little significant legislation will be effected this year. The change to a new Congress starting in 1977 will delay any significant activities for a minimum of two years. The possibility of a change in Administration in 1977 further clouds the issue.

The Interstate Commerce Commission in the past year issued a ruling in its Rate Bureau Investigation, Ex Parte 297[8]/ which will limit somewhat the activities of rate bureaus. Of particular importance are the prohibition of protesting independently announced rates of member carriers and discouraging member carriers from publishing individual tariffs. This will aid more flexible pricing by individual carriers.

b. Entry. Motor carriers must obtain a certificate of public convenience and necessity before engaging in for-hire operations. A basic criterion for receiving a certificate is proof that current carriers are not providing an adequate service. This proof must take the form of documented service failures and the burden of proof in this instance is placed upon the applicant for the new grant of authority. The legislative proposals supported by the Administration that are currently under consideration in Congress would liberalize these entry requirements. The "adequate service" test would be waived so long as proposed rates are reasonable and not industry preferential or prejudice or unjustly discriminatory. This would significantly ease the burden of obtaining a new certificate to provide service. The current view is that there will be no action taken on this issue by Congress in this session. Further, it is uncertain whether any significant developments will occur in this area in the near term future.

c. Regulatory lag. This is the delay between the time cost increases are incurred and the time the regulatory agency grants a rate increase. It has not been a significant problem recently for the motor carrier industry. The carriers and their rate-making associations have developed a procedure to provide advance submission of their cost justification statements to the Interstate Commerce Commission to secure timely approval. This has been made easier by the programmed wage increases for the Teamsters Union members which creates a condition of certainty that the carriers can address in cost justification statements.

During the recent period of rapid fuel cost increases, the carriers received relief in the form of fuel surcharges. This overcame the regulatory lag in attempting to recoup these costs. It is not envisioned that this will become a problem in the short-range future.

Other cost areas are of lesser significance and a slight delay does not have the impact that a labor lag would have.

d. Mergers. Merger activities are not a significant problem with the industry. Many mergers take the form of an end-to-end combination to add to the scope of carriers operating authority. The industry is sufficiently fragmented so that the mergers that have occurred have not created a small number of extremely large carriers. There are over 600 carriers that have revenues in excess of $1 million per year. The scales of economy are not great; therefore, it is expected that in the next several years there will not be any appreciable growth in the level of merger activity or the size of the carriers. In support of this contention, Mr. Horne of the Continental Illinois National Bank and Trust Company of Chicago concludes in his analysis of the industry that: "In 1973, in six of the nine geographic regions, the larger carriers (with revenues of $1 million to $5 million) operated less efficiently than their smaller counterparts (with revenue of $300,000 to $1 million). It would appear to this analyst that within this revenue range ($1 to $5 million) carriers begin to go through important growing pains, and that it is at this level that a carrier begins to graduate from small to large with the management headaches and the developing sophistication which must accompany growth."[9/]

The largest of these carriers, which are primarily the publicly held carriers, are able to effect certain economies of scale which have a favorable result in costs and a regulated industry. Some of these economies are the spreading of cost of communications, dispatching, billing, equipment purchase, and maintenance. Merger activity among these larger companies, however, will be somewhat limited by antitrust considerations.

2. Safety regulations.

a. Weight limits. The gross weight limit for trucks traveling the federal and interstate highway systems was raised from 73,280 pounds to 80,000 pounds by Congress in 1975. Single axle weights were raised from 18,000 pounds to 20,000 pounds and tandem axle weights were raised from 32,000 pounds to 34,000 pounds. This has had an immediate beneficial impact on the motor carrier industry's ability to increase payloads.

Due to the vocal opposition of environmental and other groups, it is not expected further weight liberalization will occur on a broad basis within the next five years. Further, it is not expected that any additional liberalization of length, heights, and width limitations will occur. There are far too many highways with standardized widths and bridge and underpass heights for any increase

in these two dimensions. The overall length of tractor-trailer combinations will probably not be increased because of objections from environmental and consumer groups.

b. Vehicle safety standards. It is anticipated that additional vehicle safety standards will be more stringent within the next five years. The immediate target is the brake system. Planned government dual braking systems would add an immediate five to eight percent to the cost of highway tractors. These provisions, which the industry is opposing, have been postponed to further study the effectiveness and reliability of the systems. It is fairly certain, however, that within the next several years, more stringent brake systems will be made mandatory. Other additional safety standards are expected to add to the cost of motor carrier operations within the next five years. At this time, it is unclear just what the magnitude of this cost will be.

c. Double and triple bottoms. Double and triple trailers up to 110 feet in length are legal by permit on designated routes in several western states. They are also allowed to operate on some toll roads in midwestern and eastern states. The operation of these combinations generates mixed reactions among the industry and consumer interests. One study concludes that triple bottoms are safer, offtrack less, stop shorter and don't jack-knife as quickly as regular tractor-trailer units. Another study also supports this view when it concluded that double and triple bottom combinations "handle as well as standard heavy-duty vehicles in service and emergency braking."[11/] Other tests in California[12/] and in Alberta, Canada[13/] also conclude that these larger tractor-trailer combinations do not create any special hazards to traffic safety and that no additional stress is applied to the pavement than that created by smaller combinations.

Even with this favorable evidence, it is not expected there will be a large increase in legalization of double and triple bottoms. It is expected that usage will be somewhat expanded to additional toll roads and some other limited access highways. The Northeast will lag behind the rest of the country.

d. 55-mile-an hour speed limit. The trucking industry was considerably affected by the national 55-mile-an-hour speed limit. It had the impact of reducing equipment utilization, while saving fuel and reducing accidents. With regard to fuel economy, one study concludes that a 5-mile-an-hour speed reduction can produce a 2.6 to 7.7 percent fuel saving.[14/] There is no consensus of agreement, however. Many trucking interests maintain that diesel engines are engineered to run at maximum efficiency at 60 to 65 miles per hour. To cope with this change, engine and truck manufacturers have taken steps to modify engines for optimum 55 to 60 m.p.h. efficiency. There are varying degrees of conformity to the reduced limits. The overall effect, however, is increased trucking costs.

3. Environmental regulations. Large trucks have been generally exempt from the emission and noise standards that have been developed for passenger vehicles. It is expected there will be some movement

toward expanding the base of vehicles to which these standards are applied. It is not clear at this time whether the large commercial tractor/trailer combinations will be made subject to increased emission control and noise abatement standards within the five-year time frame of this forecast, however. The cost of compliance with such standards would be significant for the industry. Some estimates indicate that an additional ten percent could be added to the cost of highway tractors.15/

4. Energy allocation and price regulation. The motor carrier industry will be hit hard along with other modes of transportation on any allocation of fuels. Relative to other transportation modes, it will probably not be penalized any more than the others, but obviously there will continue to be adjustments in customer service standards, and a greater amount of consolidation.

Petroleum price regulation will, in general, be beneficial to truckers and other transportation users as contrasted with petroleum suppliers, and will tend to make prices more predictable.

There is no present indication that fuel allocation and price regulation is likely to occur in the next five years, but the contingency plans are authorized under the Energy Policy and Conservation Act of 1975.

D. Technology Trends

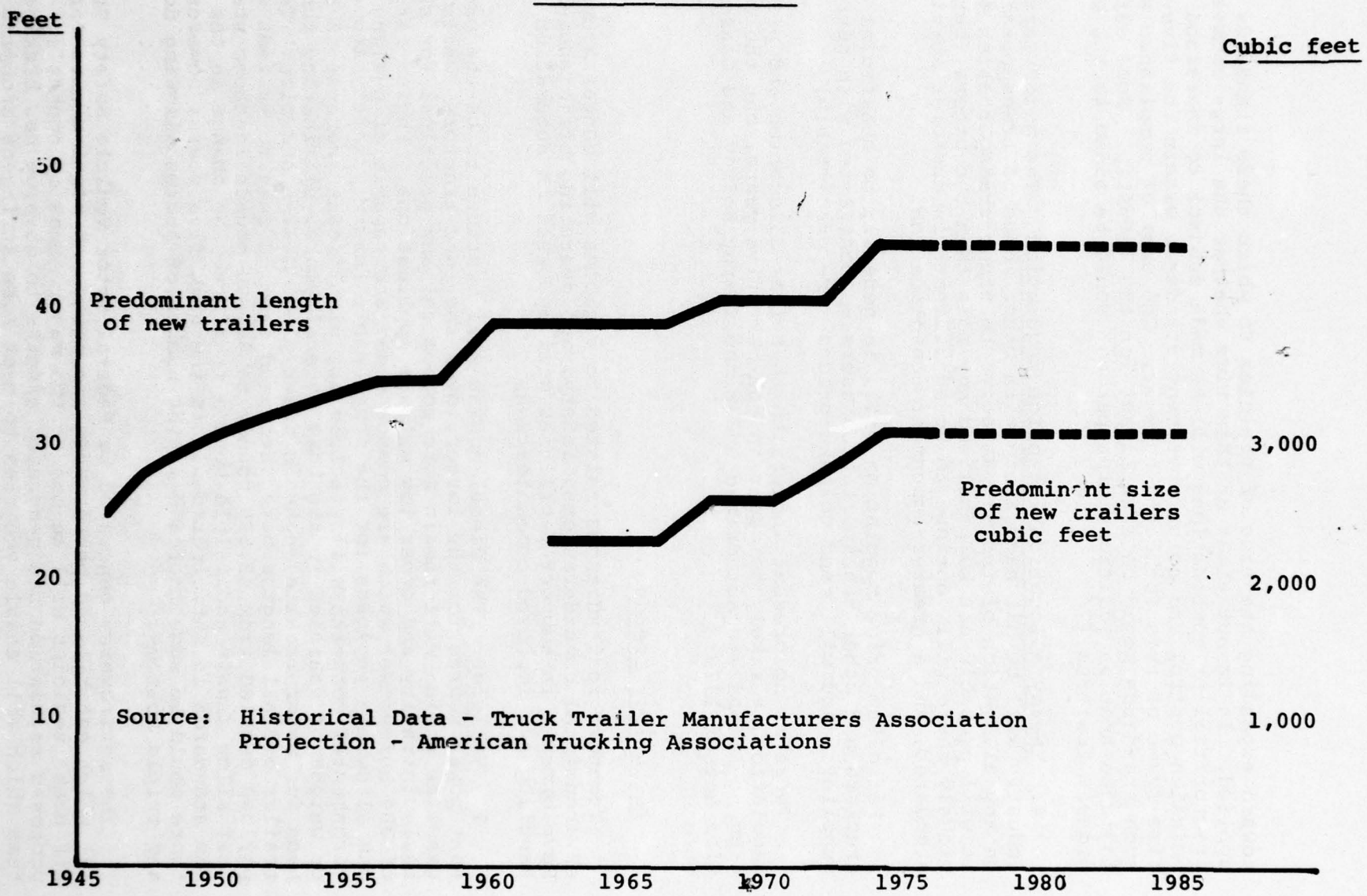
Technological advances related to vehicles will center around environmental considerations, safety, and operating efficiencies. Developments in support facilities will be based on automation of handling and improved communications.

1. Vehicles. The diesel engine will continue to be the predominant power source for the larger, over-the-road tractors, while the gasoline engine will remain more economical and practical for short-haul, intracity and other low mileage applications. Engine ratings of 300 horsepower which are common today are capable of pulling maximum allowable payloads for the foreseeable future. Safety and environmental concerns will preclude any significant increase in size or weight of vehicles in the next several years, eliminating the need for major breakthroughs in power plant design and size. Truck-trailer overall lengths have increased from 50 feet to 98 feet while payload doubled from 42,500 pounds to 86,000 pounds in those states that allow double and triple bottom trailers. No change in the maximum standards is anticipated within the next five years; however, there could be some increase in the number of states allowing double and triple bottoms.

The controversy generated by Federal Motor Vehicle Safety Standard 121 which established performance and equipment requirements for fuel air brake vehicles will be one of the major areas of emphasis. The proposed regulation has generated efforts to develop new braking systems which will enable vehicles to meet more stringent stopping

Figure V-1

Trailer Size Trends



requirements. The major area of contention, still not resolved, is the need for an axle antilock system. The trucking industry contends that use of the antilock system will adversely affect handling characteristics. This issue is still unresolved and will undoubtedly continue to be a subject of controversy between the trucking industry and the National Highway Safety Administration which issued the ruling. It is quite clear, however, there will eventually be more stringent braking systems in use on heavy-duty trucks.

Significant amounts of resources will be required to bring commercial trucks into closer compliance with environmental standards now applicable for automobiles. The Environmental Protection Agency will require reduced noise output for heavy-duty trucks. Section 18 of the Noise Control Act of 1972 establishes maximum allowable external noise standards for interstate commercial motor vehicles for the gross vehicle weight rating or combination weight of more than 10,000 pounds. This will necessitate additional insulation, exhaust systems, and other measures designed to reduce noise levels, both external and within the cabs of tractors. Exhaust systems will also have to be altered to comply with the air emission standards that apply currently to automobiles.

All additional costs for research and vehicle manufacture will be an added cost for the trucking industry. These expenditures will not enhance productivity and, thus, must be recouped through additional revenues.

Efforts to obtain operating efficiencies will include such innovations as turbo-charged diesel engines, improved vehicle aerodynamics, improved cooling systems and low rolling resistance tires all designed to improve fuel efficiency. Other reserarch efforts will concentrate on improving driving habits, elimination of unnecessary vehicle idling, lower engine operating speeds and better utilization of available vehicles.[16] It is expected that improvements in these areas will aid motor carrier productivity within the next five years.

2. Support facilities.

a. Consolidated terminals. One of the major problems of the motor carrier industry is the productivity loss in urban freight operations as a result of the generally increasing paralysis of urban motor traffic. A recent study for the Department of Transportation analyzes the benefits that can be obtained through consolidated terminals. The study concludes that the Transportation Facilitation Center (TFC) concept would provide an efficient centralized terminal facility and a common pickup and delivery fleet to reduce costs and improve service to participating carriers by reducing:

(1) The number of total vehicles through high utilization of TFC vehicles.

(2) Stem travel costs by cutting the number of trips.

(3) Zone travel by serving more shippers and receivers in concentrated areas and minimizing duplication of service.[17/]

One official closely familiar with the concept believes it will never be implemented because there is no money to do it. Further, from the review he has made of the area, there are no significant cost savings and the service is the same or slightly worse. There are also monumental problems that remain to be resolved. These include security, loss and damage, liability and the probability of traffic skimming by the carriers. This would entail the carriers' handling the "good" traffic on their own and giving the "garbage" traffic to the TFC. He has not detected any significant interest among the carriers for this concept. Another well placed observer sees little probability that this concept will be implemented on a domestic scale. However, he views good prospects on an international scale.

Because of the operational problems, shortage of money, and lack of interest, it appears that very little progress will be seen in the advancement of the Transportation Facilitation Center.

b. Automation. This will be an avenue to improvements in efficiency and productivity. Major emphasis will be on handling commodities in terminals. Much has been done in this area to date and additional strides will be made as companies grow larger through mergers and increased sales volume. It is expected, however, in the near term, that the gains through automation will not offset the increases in labor costs that will be incurred. At best, it is seen as a standoff.

3. Operational activities. Advances in reducing the cost of communications have made it feasible for an increasingly larger number of trucking companies to reap the advantages of new technology. Such areas as centralized billing, dispatching, and tracing will be implemented by an increasingly larger number of individual companies. It is not foreseen that in the short run there will be any significant strides in industrywide coordination of communications, however. A major reason for this is the very high percentage of truck shipments that are single line in nature. The only significant area of industry coordination in this regard will be in the higher implementation and utilization of standard codes for carrier and location identification. This will aid advances in statistical gathering and tariff simplification.

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SECTION VI

FUTURE AIRLINE DEVELOPMENTS

A. National Policies

1. National defense. The Department of Defense has historically relied on the commercial transport sector to support its logistic needs. In air transportation, this program has taken the form of the Civil Reserve Air Fleet (CRAF). U.S. commercial carriers have committed 246 long-range aircraft to this program to assist in deployment and resupply under mobilization conditions or any serious emergency.[1] There are approximately 100 additional shorter range aircraft for domestic and Alaskan plans. There is some concern whether this backup fleet is adequate to meet the needs of the military commitments as they are outlined today. Paul K. Carlton, Commander, Military Airlift Command, states "a full-scale crisis that called for Civil Reserve Air Fleet mobilization would demand 100 percent of the airline present cargo capacity -- in other words, all the air cargo and air freight capacity in the nation -- and that still would not be enough, especially in the area of oversized cargo."[2]

The airline industry believes that if there is indeed a shortage of CRAF aircraft, DOD air cargo policies are a contributing factor. Domestically, the use of LOGAIR and QUIKTRANS was cited as a deterrent to expansion of the civil fleet that could be available for CRAF. Internationally, the criticism is more vocal. As a recent report states:

> "DOD... moves about 90 percent of its traffic internationally by MAC;... the scheduled carriers provide about 70 percent of CRAF capability, yet receive only about 2 percent of DOD's long-range cargo and passenger business. Some say this has two bad effects: the military is wearing out its equipment, and civil carriers are not receiving the volume of military traffic which is necessary as a stimulus to commercial growth and the purchase of more cargo aircraft."[4]

The problem is recognized within the DOD. As General Carlton suggests:

> "The Government should help finance the modification of existing aircraft, as well as related downtime and operating costs. These CRAF improvements would pay off handsomely. Conservative estimates show that, to produce the same amount of airlift capability through organic Air Force means, it would cost at least 13 times the estimated price-tag of the proposed Airlift Enhancement Program."[4]

This dilemma presents a major challenge to the DOD. Whether the criticism by the commercial carriers is justified or not, it is a hurdle that must be overcome to obtain their maximum cooperation for defense programs. The challenge also is to find an equitable balance between commercial and military participation in defense air cargo transport. It is projected that some progress will be made in this area by the end of this decade. Just how much is unclear at the moment.

2. Promotional policies.

a. Operating subsidies. Subsidies to the airline industry are limited to the local service carriers. Benefits from this subsidy are primarily directed to passenger traffic from and to smaller airports. Although some of the larger trunk carriers have recently requested or indicated a need for similar subsidies (i.e., Pan Am), they were rebuffed. The current attitude in Government renders it doubtful that any such aid will be forthcoming in the foreseeable future.

b. Research and development. In Fiscal Year 1974, the federal government spent approximately $400 to $500 million on aerospace research and development programs. Much of this was conducted under the auspices of the Defense Department and includes activities and programs that have potential commercial applications.[5] No significant changes in these programs are anticipated.

c. Airport and airways development and operations. The Federal Development Act of 1970 established the Airport and Airway Trust Fund. Various user taxes are paid into this fund, including an eight percent tax on domestic passenger ticket sales and a five percent air cargo waybill tax. These monies have, until recently, been limited to the construction, improvement, and repair of public airports and the installation of navigation aids used by aircraft and requisite safety equipment.[6] In Fiscal Year 1975, $310 million was appropriated for Airport Development Aid. While few, if any, brand new major airports are anticipated within the next five years, legislation has recently been passed to provide a five-year planning and development program to improve existing airports by adding to capacity and modernizing their facilities.[7]

Specific provisions of the legislation entitled, "The Airport and Airway Development Act Amendments of 1976," include (1) an almost 100 percent increase in the funding level; (2) extension to noise abatement, and certain terminal facility development purposes; and (3) allowing use of trust fund revenues for field maintenance of airway capital facilities owned and operated by the federal government.

An administration goal of the new legislation, as summarized by the DOT Transportation Policy statement, is, "improve the equity of the airports and airways user charge system."[8] The Administration was partially successful in its attempt to extend the Airport and Airway Trust Fund, which was limited to capital

improvements of airports and airways, to operations and maintenance of the nation's air traffic control and navigation system.[9] The aviation industry opposed this measure, preferring to have the money used for additional airport and airway development projects or to reduce the user charges.[10] The aviation industry's objections to opening up the Trust Fund to operating purposes stemmed from its belief that airspace control is a general public obligation because it is jointly used for security and commercial purposes.

Although the Administration's efforts were only partially successful, the precedent has been set. It is reasonable to expect that further operations-oriented uses of trust fund monies will be authorized in the future. It is doubtful, however, that this will occur within the next five years.

3. Regulatory policies. Current Administration policy is toward freer entry/freer pricing of air transportaion as it is with the other transportation modes. Maintenance of the industry's excellent safety records is another current priority. An additional policy is to foster more efficient use of fuel consistent with conservation of energy resources. Also, on the horizon is an effort to determine the optimal domestic industry size, number of airlines and route structure to provide reliable long-haul trunkline service between major cities, to assure adequate service to smaller communities, and to enable healthy competition between efficient carriers. This route rationalization also extends to the international air transportation sector. A further goal is to resort to subsidies, direct and indirect, only when a clearly defined national interest requires development, modernization, or maintenance of an essential transportation service. In an effort to aid the financial stability of American Flag international carriers, an affirmative action program is scheduled. This program will represent U.S. interests before international bodies and protest vigorously anticompetitive and discriminatory practices by subsidized foreign carriers.

As with other policies of the current Administration, the continuance of present regulatory policies hinges on the outcome of the forthcoming elections.

B. Economic Trends

1. Management and ownership. The current inflationary atmosphere and the decline in the business for the airline industry have prompted a rash of merger discussions among the air carriers. Recently, there have been some mergers; however, these have primarily taken the form of a stronger carrier absorbing a weaker carrier. Examples of these are the Delta-Northeast and the Allegheny-Mohawk consolidations. American Airline's attempt to absorb Western Airlines was denied by the Justice Department. There have been discussions of some of the larger trunk lines combining to achieve better financial results. Among the carriers mentioned are Pan Am, TWA, Eastern, and American. However, nothing

concrete has developed to date and the outlook is cloudy at best. What is clear, however, is that the trend is toward fewer, rather than more, certificated route airlines.

The Supplemental Carriers, whose existence has been assisted in the past by overseas military charter operations, particularly Vietnam, are in a precarious position during the industrywide aviation slump. All-cargo carriers are similarly situated.

The fastest growing group of carriers -- the "Commuters" are exempt from federal regulation to the extent that "Local Service" and "Trunk-Regular Route" carriers are regulated. The Commuters are replacing local carrier service to smaller communities where local service has deteriorated primarily as a result of the acquisition of DC-9 and Boeing 737 types of aircraft for higher density routes and terminals. Their ability to carry freight is minimal except for high-priority items.

2. Financial trends. The rapid growth of passenger traffic that occurred in the 1950's prompted the introduction of the pure jet aircraft in the late 1950's early 1960's. Since passenger traffic is at least 80 percent of the airlines' revenue generator, the industry's fortunes correlate with passenger developments. The introduction of jets had a two-fold benefit to the industry: (1) it greatly increased the capacity of the airline industry and, (2) it reduced the operating cost very significantly. The 1960's were a period of rapid expansion for the industry and it was not until the late 1960's that growth rates started tapering off. The slowing of growth in both the passenger and freight sectors in the early 1970's, accompanied by rapid inflation, has left much of the industry in a precarious financial condition. The international carriers, such as Pan Am and TWA, have been particularly hard-hit. With traffic off and costs up, the airlines are left with excess airplanes for which they are incurring fixed charges. This has prompted a number of steps, such as route swaps and route sales, sale of obsolete aircraft, deferral of new aircraft deliveries, and grounding surplus planes.[11]

An additional alternative is merger of two or more carriers. Though there has been much talk about this approach, nothing more concrete has occurred since Delta absorbed financially troubled Northeast Airlines.

It is expected that the future will find increasing emphasis on merger activity. There will continue to be attempts to consolidate routes, streamline schedules, and other cost-saving measures. There is expected to be increased emphasis by the combination carriers on attracting air cargo for the bellies of their passenger aircraft.

3. Capital investment. The vast preponderance of the total U.S. airline asset structure consists of flight equipment (aircraft).[12] In 1974, the total U.S. scheduled airline's flight equipment, on a depreciated basis, was valued at $8.5 billion, compared with ground property and equipment values (which does not include airports) of $1.2 billion. This relationship reflects the continuing shift from piston and turboprop aircraft to jets, including the recently developed trijet, wide-bodied aircraft. Further, this ratio highlights the characteristics of the industry in terms of source of capital investment. The airlines provide their own flight equipment and much of their ground handling equipment for passengers and cargo. The airport facilities and many of the actual terminal structures are provided by state and local governments, and regional authorities. One exception to this is the satellite or off-airport cargo handling facilities that may or may not be owned by an individual airline or by the airline owned Air Cargo Inc.

Much emphasis and investment have been oriented to the passenger aircraft and, "until recently, cargo capacity was an insignificant or neglected by-product."[13] The DC-3, which was introduced to airline service in 1936, had no belly cargo compartment. The 200 cubic feet of available cargo space were used for passenger baggage and small amounts of express and mail. It was not until the development and introduction into service in the late 1950's of the DC-8 and B-707 that interest was generated in the potential of belly cargo space. Even the current generation of wide-bodied jet aircraft -- B-747, DC-10, and L-10011 -- has cargo capacity as a by-product of passenger carrying capabilities. The first jet all-cargo planes -- the DC-8F, and the B-707-320C -- were introduced in 1963. Since that time, all-cargo aircraft have carried more than half of the total revenue ton-miles, both domestically and internationally. The introduction in the late 1960's of the quick-change aircraft, such as the B-727 QC, by several carriers, helped accelerate this growth. However, in subsequent years, reduction of QC service and the introduction of the wide-bodied passenger aircraft has moderated the all-cargo trend.

The combination carriers who transport about one half of total air cargo ton-miles rely primarily on passenger aircraft for their cargo capacity. It is expected that no significant additional equipment will be required within the next several years. The passenger aircraft were purchased to cover a growing passenger segment which has not materialized. Recent growth rates have been much reduced and there is an excess of capacity. Many carriers have grounded or sold some of their aircraft. A recent Civil Aeronautics Board study concludes, "The airlines that operate wide-bodies will be examining the network of cargo capacity that provides them with the opportunity to develop a source of revenue at little additional cost.... The wide-bodied jet operator that also maintains all-cargo aircraft will now be weighing the economic justification in continuing extensive all-cargo service with the bellies of wide-bodied aircraft currently so underutilized."[14]

The all-cargo lines to some extent have invested in all-cargo or convertible versions of wide-bodied aircraft, although many still rely on narrow-bodied aircraft.

For both combinations and all-cargo carriers, whether using narrow-bodied all-cargo, wide-bodied all-cargo, or wide-bodied passenger aircraft, there has been an increased emphasis on use of containers. This innovation, which not only reduces handling costs, but speeds ground time, has been one of the most significant developments in the air cargo industry.

It is estimated that the majority of the cargo-related investments in the next few years will be in the form of additional narrow- and wide-bodied all-cargo aircraft, containers, and related handling systems for the all-cargo carriers. One industry source believes that the combination carriers will concentrate the majority of their cargo efforts on the wide-bodied passenger aircraft, with containerized support systems.

A recent study concludes that most domestic cargo moving less than 600 miles will move in narrow-bodied freighters and in the bellies of combination aircraft, while most long-haul cargo (domestic and international) will move in wide-bodied freighters or combination aircraft.[15] This same study projects that the industry will require 37 to 64 additional wide-bodied cargo aircraft by 1985 under normal conditions.[16] Based on conditions since the study was issued, it is projected the lower number might even be too optimistic.

4. Operating expenses. Fuel price escalation and inflation of other cost factors are the key problems affecting the air carriers. The price of jet fuel used by domestic carriers increased almost 150 percent from May 1973 to March 1975, rising from 12 to 27 cents per gallon. A recent fuel cost index was 250 (1967 = 100) compared to the consumer price index of approximately 160. The labor cost index was over 190 and the cost of landing fees was almost 230.[17]

The cost increases in fuel, particularly, have hit the airline industry harder than other modes of transportation. Fuel now constitutes almost 20 percent of the airline industry's operating cost (Schedule D-III, Forecast of Airline Fuel Costs). Salaries represent between 40 and 45 percent of the airline's cost, and when fuel and landing fees are added, these rapidly increasing cost components represent about 65 percent of the airline industry's cost structure.

There are some moderating trends that will help forestall significant declines in the air industry's participation in the freight market. There is evidence that labor demands are moderating on a selective basis. This is seen primarily in the cockpit crew sector. The lack of expectation of additional tremendous increases in fuel costs will also aid the cost control efforts. As shown in Schedule C-III -- Forecast of Airline Labor Costs -- the ratio of labor cost to total cost is projected to remain fairly stable.

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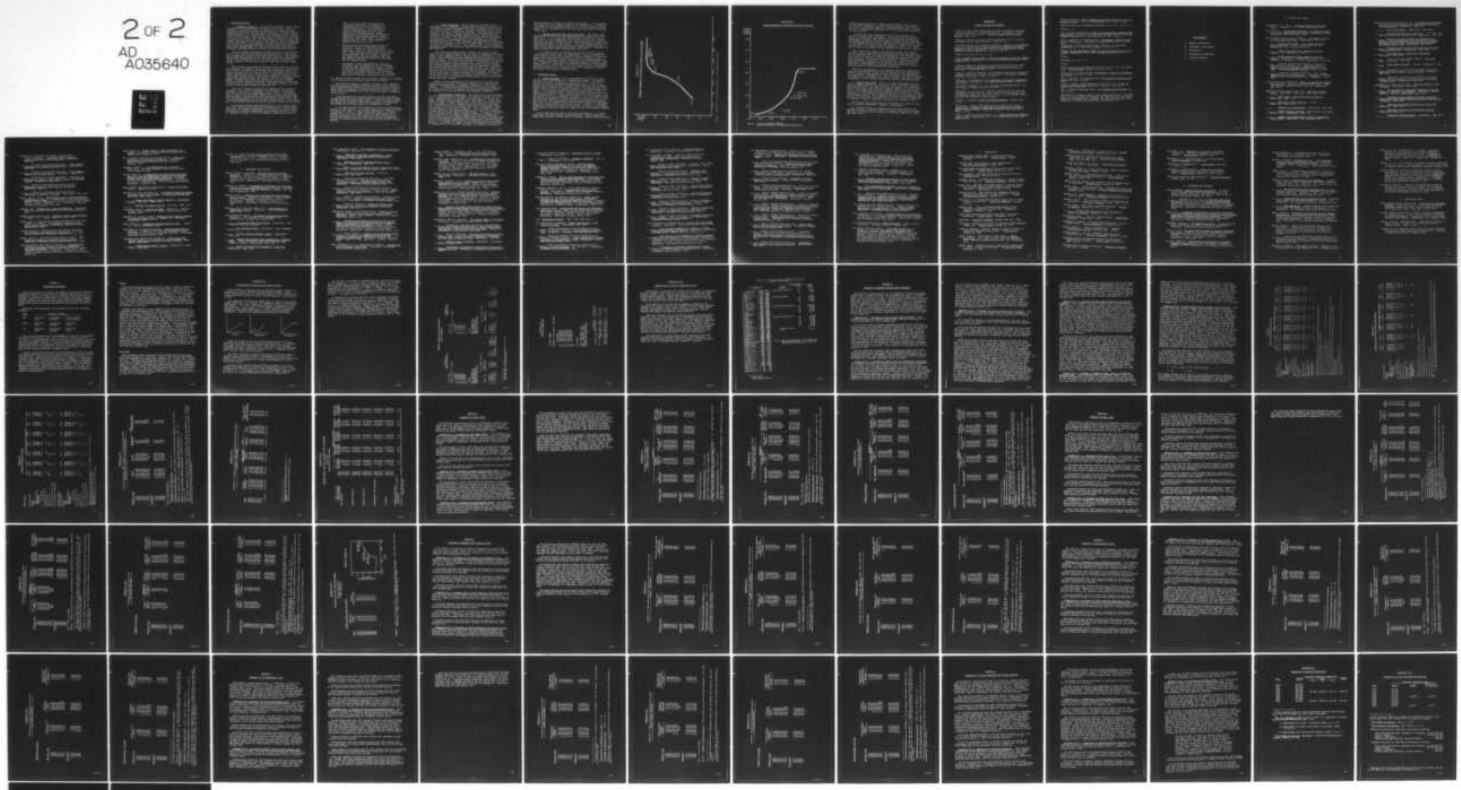

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C. Regulatory Trends

1. Economic regulation. The two most important issues facing the industry in this area are entry/exit and pricing. There is currently a significant amount of interest in liberalizing the regulatory provisions covering these two areas. The Department of Transportation in its 1974 National Transportation Report stated: "Fare regulation has caused prices to be too high on some services, and too low on others. Air carriers will need greater flexibility in setting their fares."[18] The Department of Transportation also stated, "The entry of new firms in the industry, and the expansion of existing firms into new markets, has been so rigidly controlled that no carrier has been permitted to enter trunk-line service since CAB's establishment in 1938, and with minor exceptions, no scheduled passenger service has been certificated since 1950.[19]

The DOT proposed legislation recently entitled, "The Aviation Act of 1975," which would stress the desirability of competition and de-emphasize protection of established carriers. The rationale behind this legislation is that the policy which was established by the Civil Aeronautics Act of 1938 was framed to protect an infant industry, and over the years has been used to limit competition.

This position was upheld by a special staff study of the CAB, which came to the general conclusion that "protective entry control, exit control, and public utility-type price regulation under the Federal Aviation Act, are not justified by the underlying cost and demand characteristics of commercial air transportation.[20] The staff study further states, "The present system of regulation causes higher than necessary costs and prices (which in turn suppress demand), weakens the ability of carriers to respond to market demand and other constantly changing conditions, narrows the range of price/quality choices to the user, and thus produces a misallocation of the nation's economic resources.[21]

The airline industry naturally has opposed these regulatory proposals. Mr. Arthur N. Knudsen, Vice President, Trans World Airlines, contends that deregulation could "result in concentration of service and increased competition on large, high-density, markets."[22] He further states that any carrier attempting to meet this increased competition in the high-density markets would have to consider abandoning service on money losing routes. Thus, many small- and medium-sized cities would experience curtailed service.[23]

The airline industry has recently gone on the attack to forestall the adverse provisions being advocated by the current Administration. An integral ingredient to this effort is the airline's own regulatory reform program which was recently announced. Paul R. Ignatius, President of the Air Transport Association, states,

"One of the most important aspects of reasonable regulation in scheduled air transportation involves the concept of route certification -- the assurance of regular scheduled service over a given route for an extended period. Route certification lets passengers and shippers, communities, and airport operators know where they stand with respect to available airline service. That is why Congress embodied the concept in law.

Provisions of the proposed Aviation Act of 1975 would degrade the concept of route security. I refer to the provisions on route entry and exit. Entry would be virtually free. Exit would be much easier for carriers in many markets than it is today. Clearly, you cannot have free entry without free exit, and together they spell trouble for the users of air transportation.

One result of free entry/free exit would be a headlong rush to concentrate on the heaviest travelled, most profitable air routes. Another result would be abandonment or diminution of air service in lighter markets. The net result would be a shrinking of the present air transport system, and less scheduled air service."[24/]

Mr. Ignatius further states that regulatory tampering is unlikely to cut the carrier costs upon which rates are based.

The airline industry's proposals include a test period for pricing flexibility whereby airlines would be free to raise or lower passenger and cargo rates up to 15 percent above or below basic rates. Proposals for establishment of a zone of flexibility have been promoted for other regulated modes of transportation as well.

A second provision involves reducing the time involved in regulatory actions and proposes setting a maximum time of three or four months on various CAB actions. Other provisions provide for making the regulatory body more independent and improving the Presidential review process of international cases.

It is expected that some change will come in the regulatory aspects of the industry. It is most likely this change will come in the pricing area. A zone of reasonableness is a distinct possibility. It is not likely that total deregulation as it affects entry/exit will occur within the next several years. The pricing flexibility will allow the carriers to adapt more quickly to changed conditions and should enhance overall profitability.

2. Safety regulation. The airlines are the most highly regulated of the commercial transportation modes as regards safety. The Federal Aviation Administration (FAA) is charged with setting and enforcing safety standards, including operating rules, certification of airmen, aircraft and airports. FAA also operates and maintains the nation's airways system which is responsible for providing the safe separation between aircraft and the efficient flow of air traffic. The success of this program is indicated by the Department of Transportation in its Statement of National Transportation Policy. This indicates that the domestic scheduled air carriers averaged for the 1971-73 time frame .13 fatalities per 100 million passenger miles. This compares with .28 for railroad passenger trains, .21 for buses, and 1.80 for passenger automobiles and taxis.[25]

Even with this safety record, however, the airline safety issue is very visible because any air crash is treated on the front pages of the newspapers and in the nationwide TV broadcasts. The recent rash of near-misses has prompted increasing attention to air traffic safety. The key issues are congested metropolitan airports and "overworked" air traffic controllers. A program by the FAA to develop an upgraded third generation air traffic control system will further enhance safety through aircraft separation assurance and wake turbulence detection among other things. The impact on the nation's air carriers will be slight as the federal government picks up the cost of the air traffic control system. Recent legislation allows user charges to be used for maintenance of airway facilities; however, the cost continues to originate from the users of the service -- the passengers and shippers -- and the airlines merely pass them through.

Recent concern expressed by the Airline Pilots Association concerning the carriage of hazardous materials in airplanes has caused a re-examination of allowable commodities in air cargo service. It is believed the end-result of this re-evaluation will be tighter controls over shipments of hazardous materials and/or an elimination of the carriage of such materials altogether.

3. Environmental regulation. The three major areas impacting on the aviation industry are noise, air quality, and airport location. Implementation of programs to reduce noise levels and aircraft emissions could adversely impact the industry. Current proposals to permit airport projects to include such land acquisition as is necessary to assure compatibility with adjacent land uses will raise the cost of new airport construction and airport expansion assuming the land can be obtained. This is expected to have a minor impact on the airline industry, as no new major airports are planned within the next five-year period. The goal of confining severe aircraft noise exposure levels around U.S. airports to the areas included in the airport boundary could be more expensive. This policy, which will include regulations on aircraft engine noise, aircraft operational procedures, and airport grant program requirements, also includes those relating to compatible land uses around airports. The amount of impact in this area depends upon the degree of retroactivity of new higher standards to aircraft certified by

the FAA before such higher standards were adopted. It is expected that there will be a phase-in period if retroactivity is included to spread out the financial burden to the airline industry and the costs of noise abatement may well come from the Airport and Airway Trust Fund.

4. Energy allocation and price regulation. The growth rate projections for the air cargo industry could be tempered by higher fuel costs. It is likely that the marginal freight attracted to the mode will not be dependent upon the price of service, however, since most of that freight would go almost regardless of price (e.g., emergency shipments of spare parts). Price movements probably have been a major source of past growth, as average revenues per ton-mile did not change appreciably between 1958 and 1975, compared with upward movements in most transportation prices.[26]

It is expected that any allocation measures would hit the air cargo industry harder than its competitors. This is because the air industry is relatively energy-inefficient compared to the other modes. Government policy will have a goal of promoting energy efficiency. Any price regulation measures will probably have more of a stabilizing effect than an inhibiting impact on industry. Air cargo, however, is expected to be adversely affected to some extent by higher fuel prices. This is mainly because fuel cost represents almost 20 percent of the airline's total cost compared to five to ten percent for competing freight modes.

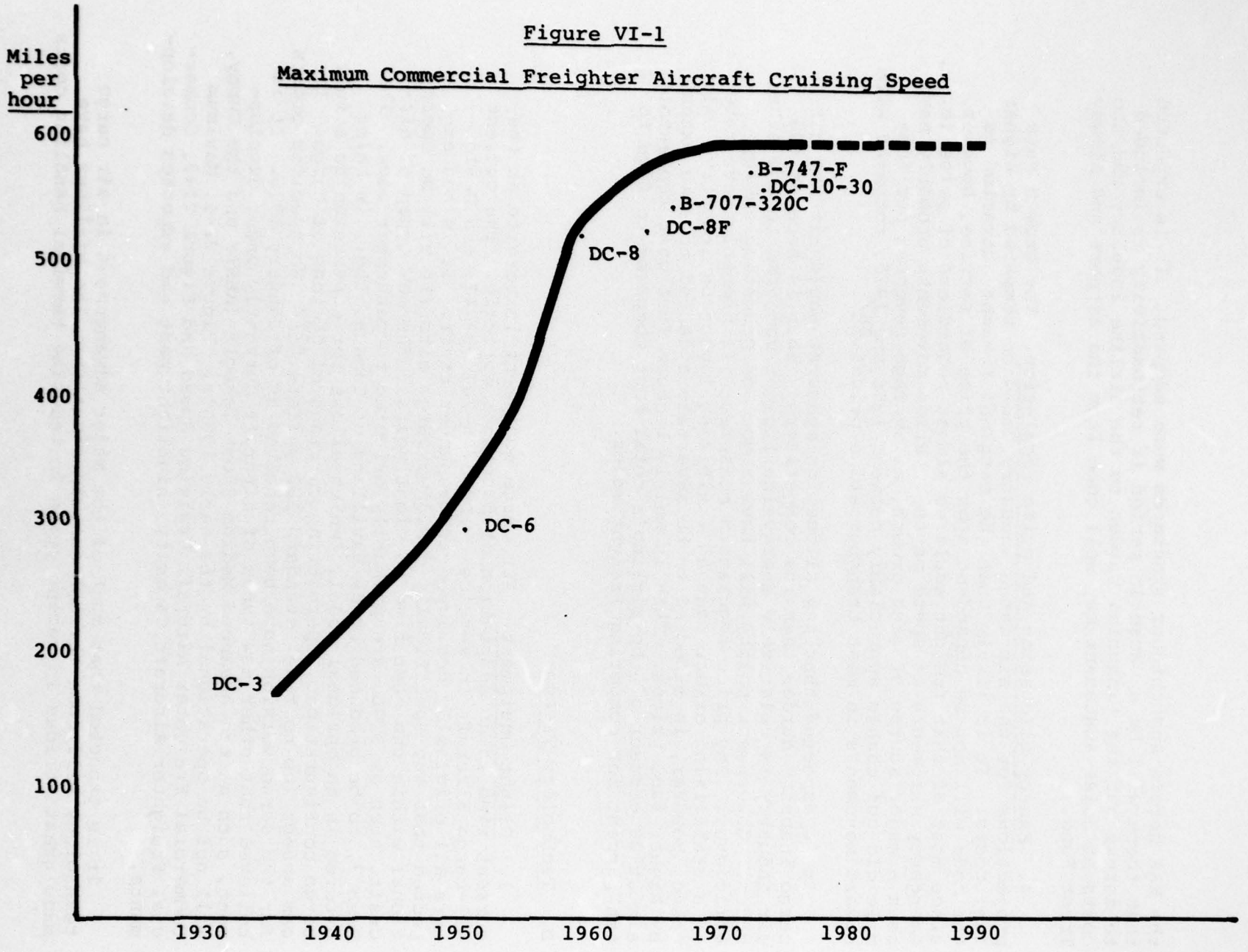
D. Technology Trends

1. Flight equipment. Air cargo equipment in service at the current time is an adaptation of passenger aircraft. The current all-cargo aircraft in service -- DC-8, B-707, B-747, and DC-10 -- were all originally developed as passenger craft. It is not expected that any specifically designed cargo aircraft will be operational within the next five to eight years. The new types of aircraft, such as STOL, are primarily oriented to passenger uses. The Dash 7, to be produced by de Havilland of Canada, Ltd., is being offered in an optional model, "which allows for conversion to a full cargo configuration... permitting carriage of 5½ tons of cargo. It can accept (up to five) standard LD3 pallets."[27] No specific orders for the cargo version have been received as of January 1976. It is believed that other new types of aircraft currently under development, such as the Advanced Medium Short Takeoff (AMST) and the Guppy, will not be operational by the early 1980's. Figure VI-1, Maximum Commercial Freighter Aircraft Cruising Speed and Figure VI-2, Commercial Freighter Aircraft Capacity, highlight past and expected developments.

It is expected that much of the major advancement in air cargo technology will come through containerization. The airlines have made great strides in recent years in reducing terminal handling costs

Figure VI-1

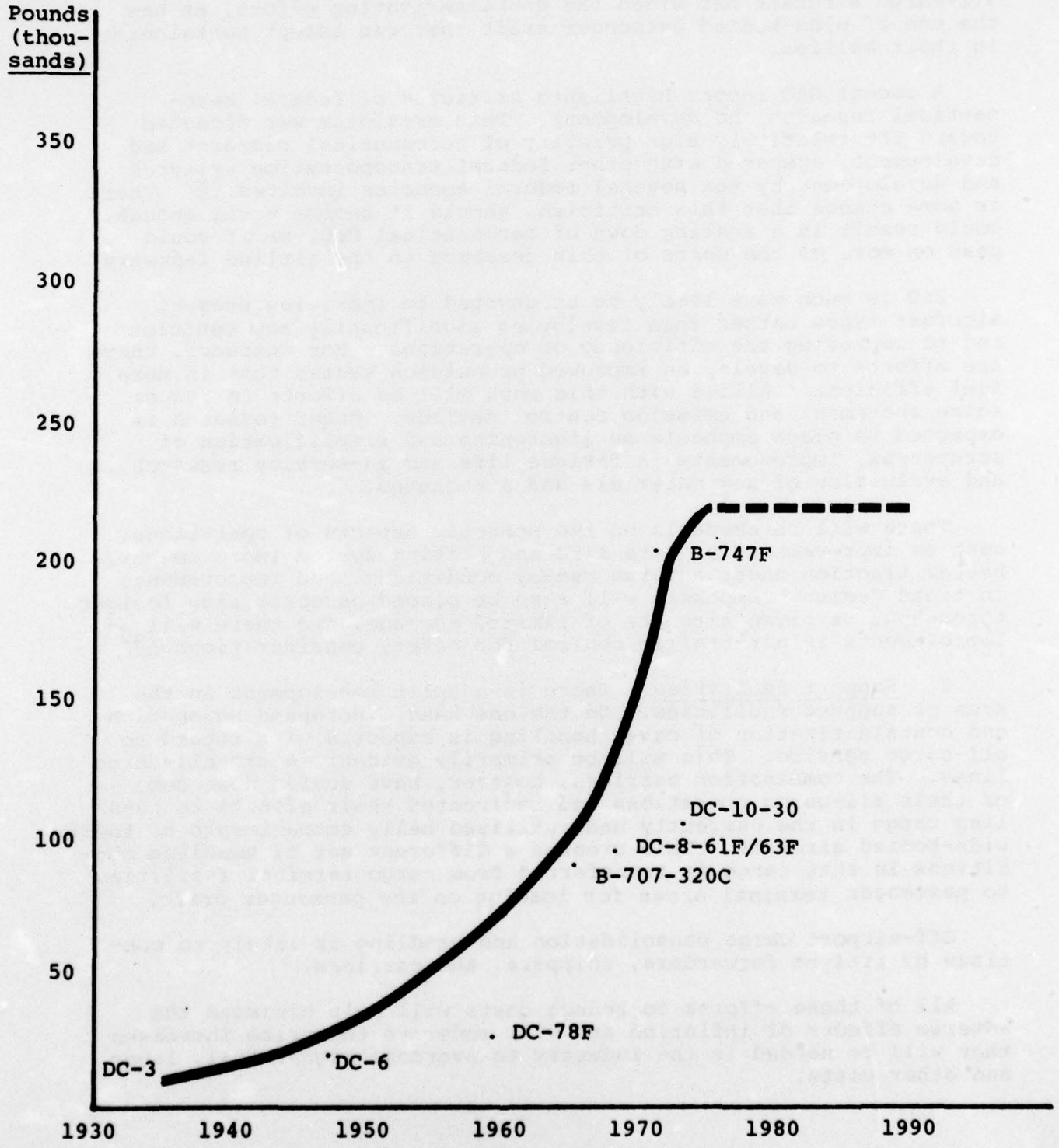
Maximum Commercial Freighter Aircraft Cruising Speed



Source: Jane's All The World Aircraft, Civil Aeronautics Board

Figure VI-2

Maximum Commercial Freighter Aircraft Capacity



Source: Civil Aeronautics Board
Systems Analysis and Research Corporation

through containerization. Some of the problems, such as lack of container standards, are slowly being overcome. The growth of all-cargo aircraft has aided the containerization effort, as has the use of wide-bodied passenger craft that can accept containers in their bellies.

A recent GAO report highlights criticism of federal aeronautical research and development. This criticism was directed toward the relatively high priority of aeronautical research and development, compared with other federal transportation research and development by the several federal agencies involved.[28] There is some chance that this criticism, should it become vocal enough, could result in a scaling down of aeronautical R&D, or it could pass on more of the costs of this research to the airline industry.

R&D is much more likely to be devoted to improving present aircraft types rather than developing significantly new vehicles and to improving the efficiency of operations. For instance, there are efforts to develop an improved propulsion system that is more fuel efficient. Allied with this work will be efforts to reduce noise abatement and emission control devices. Other research is expected to place emphasis on lightening and simplification of structures, improvements in fatigue life and in-service research and evaluation of new materials and structures.

There will be emphasis on the economic aspects of operations, such as improvements of tire life and braking system improvements, better traction under adverse runway conditions, and improvements in tread design. Emphasis will also be placed on optimizing freight throughput at given airports of limited acreage, and there will be improvements in air traffic control for safety considerations.[29]

2. Support facilities. There is a split development in the area of support facilities. On the one hand, increased automation and containerization of cargo handling is expected with regard to all-cargo service. This will be primarily evident in the all-cargo lines. The combination carriers, however, have scaled down some of their all-cargo operations and redirected their efforts to handling cargo in the currently underutilized belly compartments of their wide-bodied aircraft. This creates a different set of handling conditions in that cargo is transferred from cargo terminal facilities to passenger terminal areas for loading on the passenger craft.

Off-airport cargo consolidation and handling is likely to continue by freight forwarders, shippers, and carriers.

All of these efforts to reduce costs will help minimize the adverse effects of inflation and will moderate the price increases that will be needed in the industry to overcome higher fuel, labor, and other costs.

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EXHIBIT A

FORECASTING TECHNIQUE

The DS/SD forecast is similar in concept to the general evaluation techniques employed by the Interstate Commerce Commission and Civil Aeronautics Board in reviewing carrier requests for freight rate increases. One essential difference is that these regulatory agencies evaluate carrier rate increase petitions based upon immediate needs, whereas DS/SD has projected current carrier cost trends and revenue needs under various long-range investment considerations and profit goals.

Therefore, the development of increases involves the following elements:

Mode	Forecast element		
Rail	Operating cost	Originated tonnage	Rate of return on investment
Motor	Operating cost	Originated tonnage	Operating ratio
Air	Operating cost	Originated tonnage	Operating ratio

The base period used for the development of data was, with several exceptions, 1967 through 1974. This period was selected because: (1) 1967 is a recognized base year for statistical purposes by carriers and many government sources; (2) carriers during this period experienced unprecedented increases in operating costs and the need to seek offsetting freight rate increases, and (3) this period is considered more typical in its reflection of continuing trends and is more germane to the forecast period of interest to DOD.

Several alternative curve-fitting techniques were tested to establish which technique had the best overall correlation with the historical data base. This involved three (3) basic types of curve fits -- straight line, exponential, and hyperbolic. Examples of these curve-fitting techniques, including their respective indexes of determination or correlation with the base data, are illustrated in Schedule A-I -- Alternative Curve-fitting Formulae Tested. The Straight-line Regression Analysis, represented by the formula $Y = A + B (X)$, was chosen as the overall best curve-fitting technique to forecast the elements involved because it consistently had one of the highest indexes of determination.

Method

We developed separate projections for operating costs, orginating tonnage, and revenue requirements for each mode. Operating cost projections for each category were based upon a common unit of measure, the ton-mile. This unit was selected since distance and volume combine to produce operating costs. In addition it: (1) provides a universal base for making revisions or adjustments to the forecast, (2) facilitates analytical comparisons of one mode to another, and (3) is the most widely used measurement by carriers, government agencies, and carrier trade associations. Therefore, operating costs by category and in total are the product of changes in cost per ton-mile and changes in ton-miles.

Revenue requirements are the product of this required return on investment plus operating costs. The procedure for establishing the required return on investment varies by mode and is discussed in the appropriate Schedules of Exhibit B. The forecast of originating tonnage and total revenue requirements was combined to establish revenue needs per ton. This approach, rather than ton-miles, was used to project revenue requirements per ton since revenue and revenue increases are most directly impacted by tonnage. Ton-miles, on the other hand, treat mileage and tonnage changes equally. This approach reduces overall projected revenue needs to a common unit of measurement that can be used to forecast freight rate requirements. The per ton revenue figures represent the average freight rate being charged for one ton of freight. Thus, freight rate increases can be projected by measuring the change in per ton revenue requirements. The amount of difference in per ton revenue from one year to the next reflects the amount of freight rate increase required. Projected increase in freight rates from 1976 to 1977 were calculated by dividing the per ton revenue requirements for 1977 by the 1976 per ton revenue requirements. The resulting percentage increase represents the average increase that will be required in freight rates to raise the 1976 per ton revenue to the 1977 per ton revenue level.

Cost Data

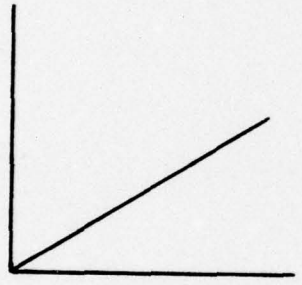
The procedures used to construct and forecast carrier operating costs were the same for each mode. Similar cost factors were identified and assembled into major cost categories as is outlined in Schedule A-II -- Aggregation of Operating Costs. As a result, all operating costs have been classified into one of five broad cost categories: labor, fuel, material and supplies, depreciation and/or miscellaneous expenses. Each of these cost categories has been treated individually in separate Exhibits, and the total projected cost for each of those categories has been summarized in Exhibit B -- Forecast of General Freight Rate Increases to develop the total projected operating costs by mode for 1977 through 1982.

Schedule A-I

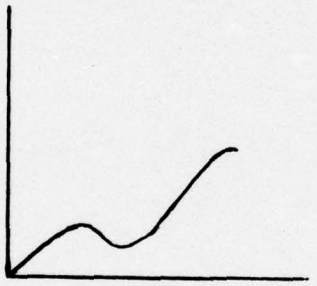
Alternative Curve-fitting Formulae Tested

This Schedule illustrates the six formulae tested by DS/SD in developing our final statistical forecasting strategy. These formulae represent three (3) different types of curve-fitting techniques which can be used to project trends based on a given series of data.

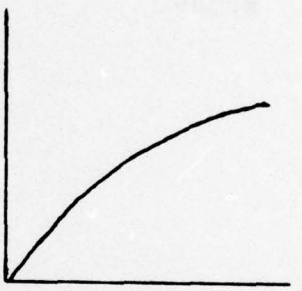
The technical terms for the three types of curve-fitting techniques tested are: (1) linear, (2) hyperbolic, and (3) exponential regressions. The linear regression formula is expressed as curve-type number 1. $Y = A + (B \cdot X)$ in the examples illustrated in this Schedule; curve types number 2, 4, 5, and 6 represent hyperbolic regressions and curve type number 3 represents an exponential regression. These can be graphically illustrated as follows:



Linear



Hyperbolic



Exponential

DS/SD has chosen to use the linear regression curve-fitting technique for projecting all carrier operating costs. In addition, this method was also used to forecast the Class I railroad net investment figures in Schedule B-I -- Forecast of Rail Freight Rate Increases and modal tonnages in Schedule B-IV -- Forecast of Rail, Motor Carrier, and Airline Tonnages.

The linear regression analysis was chosen as the best overall curve-fitting technique because it consistently had one of the highest correlation factors of all the curve-fitting formulae tested. This factor is expressed as the "index of determination" in the following examples.

The data under columns entitled "YRS" and "EMPL" in the first example below represent the historical employment data for Class I railroads for 1967 through 1974. 1967 is expressed as Year 1, 1968 as Year 2, etc. The figures under the caption "EMPL" represent the number of railroad employees for each year respectively.

The "A" and "B" figures are substituted for the A and B values in the formula Y = A + (B·X). The "X" value is equal to the number that is applicable to the year being projected; hence, the year 1977 would be represented by the number 11 since it would be the eleventh year in the sequence (1 = 1967, 2 = 1968..... 11 = 1977). Substituting the values for A, B, and X in the linear regression formula Y = A + (B·X), railroad employment in 1977 is projected as 617,927 + (-13,400.1·11) = 470,526.

A slightly more accurate curve fit can be obtained by substituting the actual years for the 1, 2, 3..... sequence. This was not done in the initial testing data because this method involves more machine time and capacity than the 1, 2, 3..... method. The 1, 2, 3..... method served as a useful tool to determine the best overall curve-fitting strategy. Example number 3 in this Schedule illustrates the linear regression technique using the actual year method. This results in the number of employees for 1977 being projected as 26,963,000 + (-13,400·1977) = 471,200. Actual years were used in all the DS/SD linear regression analyses used in this study.

Examples of Curve-fitting Formuli Tested[a]

Class I Railroads

(Example 1)
Number of employees

```
TITLE: LABOR

COLUMN TITLES OR #: YRS,EMPL

    YRS,EMPL
1#  1,610191
2#  2,590536
3#  3,578277
4#  4,566282
5#  5,544333
6#  6,526061
7#  7,520153
8#  8,525177
9#

3>CURVE

IND. VARIABLE: YRS
DEP. VARIABLE: EMPL
COLUMN OF WEIGHTS:
COLUMN FOR RESIDUALS:
COLUMN FOR COEFFICIENTS:
```

LEAST SQUARES CURVES FIT

CURVE TYPE	INDEX OF DETERMINATION	A	B
1. Y=A+(B*X)	.945336	617927.	-13400.1
2. Y=A*(X↑B)	.927349	620992.	-.823942E-01
3. Y=A*EXP(B*X)	.946832	618977.	-.239075E-01
4. Y=A+(B/X)	.765507	523467.	100547.
5. Y=1/(A+(B*X))	.947505	.160675E-05	.427242E-07
6. Y=X/(A+(B*X))	.731751	-.313071E-06	.190537E-05

(Example 2)
Employee wages[b]

```
TITLE: LABOR

COLUMN TITLES OR #: YRS,WAGES

    YRS,WAGES
1#  1,8759
2#  2,9454
3#  3,10101
4#  4,11036
5#  5,11920
6#  6,13395
7#  7,15152
8#  8,16370
9#

5>CURVE

IND. VARIABLE: YRS
DEP. VARIABLE: WAGES
COLUMN OF WEIGHTS:
COLUMN FOR RESIDUALS:
COLUMN FOR COEFFICIENTS:
```

LEAST SQUARES CURVES FIT

CURVE TYPE	INDEX OF DETERMINATION	A	B
1. Y=A+(B*X)	.970756	7066.25	1101.59
2. Y=A*(X↑B)	.869883	7927.05	.287499
3. Y=A*EXP(B*X)	.891182	7801.19	.911887E-01
4. Y=A+(B/X)	.956443	14407.1	-7016.46
5. Y=1/(A+(B*X))	.997736	.121731E-03	-.774059E-05
6. Y=X/(A+(B*X))	.706811	.543245E-04	.684428E-04

---

[a] Includes linear, exponential and hyperbolic curve fits.
[b] Includes salary and fringe benefits.

(Example 3)
Number of employees

```
TITLE: LABOR

COLUMN TITLES OR #: YRS,EMPL

    YRS,EMPL
1#  1967,610191
2#  1968,590536
3#  1969,578277
4#  1970,566282
5#  1971,544333
6#  1972,526061
7#  1973,520153
8#  1974,525177
9#

2>LINEAR

IND. VARIABLE: YRS
DEP. VARIABLE: EMPL
COLUMN FOR RESIDUALS:
COLUMN FOR COEFFICIENTS:


                INTERCEPT = .26963E+08
  REGRESSION COEFFICIENT =-.13400E+05

STD. ERROR OF REG. COEF. = 1315.506
        COMPUTED T-VALUE =  -10.186

 CORRELATION COEFFICIENT =      .972
  STD. ERROR OF ESTIMATE = 8525.451
```

Schedule A-II

Aggregation of Carrier Operating Costs

This Exhibit illustrates the method used by DS/SD in aggregating carrier operating costs into one of the five (5) broad cost categories of labor, fuel, material and supplies, depreciation, and miscellaneous expenses. These cost categories were then used as a basis for forecasting future carrier operating costs on an individual cost-by-cost and total-cost basis.

This Schedule, for illustration purposes, aggregates the various Class I motor carrier cost elements that have been combined together to represent total "labor" costs for 1972. These costs include administrative salaries, supervisory expenses, direct salaries and wages, and employee fringe benefits.

DS/SD has reviewed all the functional carrier operating costs reported under "carrier operations" and assembled the individual labor cost elements into total "labor" costs disregarding the functional nature of the cost characteristics. This approach preserves the integrity of the cost categories developed by DS/SD to the extent that each cost category reflects only those costs associated with that particular operation, i.e., material and supplies costs reflect only the cost of material and supplies, other than fuel, and do not include labor costs associated with obtaining or controlling the storage and handling of material and supplies.

The aggregation of other motor carrier operating costs was accomplished using the method illustrated in this Schedule. In addition, this method was also used to aggregate carrier operating costs for Class I railroads and all-cargo U.S. airlines.

Financial and Operating Statistics of General Freight Carriers
(Class I motor carriers)

Carrier operations
(1972)

ORDINARY ITEMS	a UNITED STATES TOTALS 494 CARRIERS	b
OPERATING REVENUES		
1 Freight Revenues Intercity Common Carrier	2244 460 470	8045 852 440
2 Freight Revenues Intercity Contract Carrier	572 078	2 050 243
3 Freight Revenues Local Cartage	20 943 540	70 212 004
4 Intercity Expns For Other Carriers (All Carriers)	8 981 156	18 515 892
5 Other Operating Revenue	3 184 361	12 704 382
6 TOTAL OPERATING REVENUES	2278 106 802	8155 336 058
OPERATION AND MAINTENANCE EXPENSES		
7 Equipment Maintenance	194 531 490	696 391 875
8 Supervision	11 105 344	39 030 177
9 Office And Other Expenses	674 490	2 323 153
10 Long Haul Equipment	120 878 800	485 875 950
11 Pickup And Delivery Equipment	32 467 478	115 225 044
12 Employees Welfare Expenses	6 704 016	25 354 210
13 All Other	13 831 368	48 783 541
14 Transportation	1004 973 849	3620 334 702
15 Supervision	35 503 133	125 828 610
16 Office And Other Expenses	1 464 167	5 745 530
17 Drivers And Helpers Line Haul	342 687 779	1207 792 852
18 Drivers And Helpers Pickup And Delivery	288 994 882	1022 288 861
19 Employees Welfare Expenses	54 601 263	202 457 927
20 Fuel And Oil For Line Haul Equipment	44 824 852	180 308 988
21 Fuel And Oil For P & D Equipment	8 482 713	33 385 870
22 Purchased Transportation		
23 Equip Rents - Intercity - With Drivers	57 886 246	191 288 209
24 Equip Rents - Intercity - Without Drivers	85 172 198	288 863 970
25 Other Purchased Expns Intercity	14 857 268	38 524 938
26 Equip Rents P & D With Drivers	8 077 008	27 570 817
27 Equip Rents P & D Without Drivers	14 085 831	48 140 243
28 Other Purchased Expns P & D	30 819 833	108 420 848
29 Equipment Rents Credit		
30 For Intercity Revenue Vehicles	8 814 450	33 920 278
31 For P & D Revenue Vehicles	67 540	1 058 359
32 All Other	28 215 830	100 818 380
33 Terminal	475 376 720	1688 418 372
34 Supervisory Salaries	38 467 565	137 140 990
35 Salaries And Fees Billing And Collecting	39 276 148	143 556 428
36 Other Office Employees	31 343 540	110 481 850
37 Office And Other Expenses	12 119 222	44 206 918
38 Salaries And Wages Platform Employees	241 885 077	835 730 833
39 Employees Welfare Expenses	30 872 841	112 768 087
40 Other Terminal Employees	23 760 773	83 399 574
41 Commission Agents	7 855 371	28 847 539
42 All Other	48 493 877	173 283 478
43 Traffic	67 080 030	237 425 742
44 Supervision	42 827 154	149 988 217
45 Employees Welfare Expenses	2 848 483	10 184 939
46 All Other	21 384 393	77 252 590
47 Insurance And Safety	74 322 599	293 271 584
48 Supervision	9 804 926	35 909 730
49 Office And Other Expenses	2 320 823	8 148 823
50 Public Liability And Property Damage	17 276 960	67 907 288
51 Workmen's Compensation	14 829 337	59 911 925
52 Employees Welfare Expenses	724 343	2 627 430
53 Cargo Loss And Damage	24 588 825	100 222 900
54 Fire, Theft And Collision	2 988 787	13 802 020
55 All Other	1 301 798	4 840 879
56 Administrative And General	117 852 813	420 190 209
57 Salaries-General Officers	16 705 511	59 757 396
58 Salaries-Revenue Accounting	14 683 199	52 986 905
59 Salaries-Other General Office Employees	21 852 700	78 785 849
60 Employees Welfare Expenses	6 297 049	21 242 198
61 All Other	58 505 058	207 418 065
62 TOTAL OPERATION & MAINT. EXPENSES	1933 910 200	6837 032 344
OTHER EXPENSES		
63 Depreciation Expense	80 382 400	292 304 539
64 Line Haul Equipment	62 486 327	181 464 520
65 Pickup And Delivery Equipment	14 600 740	51 718 891
66 Depr-Service Cars, Shop & Garage Equip	2 614 880	8 248 954
67 Depr-Misc. Equipment	3 110 520	11 339 679
68 All Other	7 872 353	28 536 865
69 DEPRECIATION ADJUSTMENT	8 182 058	33 738 706
70 AMORT OF CARRIER OPERATING PROPERTY	30 033	101 525
71 Operating Taxes And Licenses	128 749 833	528 084 578
72 Line Haul Equipment(Fuel)	40 600 104	143 757 701
73 Pickup And Delivery Equipment(Fuel)	7 334 195	25 850 559
74 Line Haul Equipment(Vehicles)	27 019 027	99 850 095
75 Pickup And Delivery Equipment(Vehicles)	8 411 872	30 850 748
76 Social Security Taxes	35 048 842	185 503 529
77 All Other	10 538 763	40 471 850
78 TOTAL EXPENSES(ITEMS 62,63,69,70 AND 71)	2134 918 315	7631 784 278
79 Net Operating Revenue (Line 6 Less 78)	144 188 487	523 550 780
80 Other Income	7 873 882	25 805 460
81 Total Other Deductions	10 827 962	70 185 899
82 Lease Of Distinct Operating Unit - Debit	283 795	1 021 234
83 Other Deductions	10 584 167	69 164 665
84 ORD. INC. BEF. INCOME TAXES(ITEMS 79+80-81)	132 234 807	478 980 341
85 Income Taxes On Ordinary Income	51 804 288	208 160 338
86 ORDINARY INCOME(ITEM 84 LESS ITEM 85)	80 430 100	270 850 003
EXTRAORDINARY & PRIOR PERIOD ITEMS		
87 Extraordinary Items - Net Credit (Debit)	98 171	64 074
88 Prior Period Items - Net Credit (Debit)	1 888 320	2 012 420
89 Income Taxes Applicable Debit (Credit)	18 214	16 327
90 Total Extraord. & Prior Items (87, 88&89)	1 646 372	1 964 682
91 Net Income Or Loss (Item 86 & Item 90)	78 783 737	268 885 321
92 Operating Ratio (Item 78 Divide Item 6)	93 7	93 6
OPERATING STATISTICS INTCY SERVICE		
93 Trk & Tractor Miles (Common)	1748 144 330	6348 144 537
94 Trk & Tractor Miles (Contract)	817 888	2 488 288
95 Tons Of Rev. Frt. (Bill Wgts)(Common)	98 251 608	204 808 033
96 Tons Of Rev. Frt. (Bill Wgts)(Contract)	85 815	261 903
97 Total Miles Oprd. Owned Vehicles	1252 188 057	4533 744 311
98 Total Miles Oprd. Veh. Rented With Drivers	107 712 542	386 570 328
99 Total Miles Oprd. Veh. Rented Without Drivers	388 887 772	1429 237 190
100 Dispatched Miles Operated In Intercity Service	90 836	84 027
101 TOTAL MILES ALL VEHICLES(ITEMS 97 THRU 100)	1748 857 207	6348 810 820
102 Miles Rail And or Water Services	38 245 476	89 928 313
103 Ton Miles Rev. Frt. Highway Service *	23 343 850	83 605 421
104 Ton Miles Rev. Frt. Rail&Water Services *	482 505	1 258 404
105 Total Ton Miles(Items 103&104) *	23 832 482	84 863 831
106 Freight Revenue From Intercity Serv (Items 1&2)	2244 892 549	8047 902 689
Road Miles In P&D Serv. By Line Haul Vehicle		
107 Vehicles Owned	4 005 380	18 263 540
108 Vehicles Rented With Drivers	100 183	280 901
109 Vehicles Rented Without Drivers	1 140 910	3 591 243
Road Miles In Line Haul Serv. By P&D Vehicles		
110 Vehicles Owned	10 352 749	70 082 044
111 Vehicles Rented With Drivers	277 148	1 089 282
112 Vehicles Rented Without Drivers	2 284 888	8 056 818
Road Miles In P&D Service By P&D Vehicles		
113 Vehicles Owned	31 685 776	117 487 620
114 Vehicles Rented With Drivers	887 100	2 282 212
115 Vehicles Rented Without Drivers	8 534 817	30 324 630
116 Freight Revenue From Intercity Service(TL)	814 812 713	2860 787 814
117 Freight Revenue From Intercity Service(LTL)	1430 180 332	5187 105 075
118 Tons Of Intercity Revenue Freight(TL)	38 193 323	129 446 898
119 Tons Of Intercity Revenue Freight(LTL)	20 123 900	75 823 150
120 Number Of Intercity Shipments Carried(TL)	2 430 502	8 850 885
121 Number Of Intercity Shipments Carried(LTL)	58 200 820	210 818 012
122 Revenue Per Ton Mile(Item 106 105)	$ 094	095
123 Revenue Per Ton (Item 106 (95&96))	$ 38 88	39 24
124 Revenue Per TL Ton(Item 116 118)	$ 22 61	22 10
125 Revenue Per LTL Ton(Item 117 119)	$ 71 07	68 88
126 Average Load Tons(Item 103 101)	13 30	13 10
127 Average Haul Miles(Item 105 (95&96))	423 1	413 8
128 Avg. Shipment Lbs(Items (118&119)x2000)	1 859	1 801
129 Avg. TL Shipment Lbs(Item 118 120)x2000	30 797	29 224
130 Avg. LTL Shipment Lbs(Item 119 121)x2000	690	691
131 Net Profit Margin(Item 91 6)	3 4	3 3

* Add 000

Component	Line no.	Expense ($000)
Administrative salaries	57	59,757
	58	52,987
	59	78,786
Supervisory expense	8	39,030
	15	125,829
	34	137,141
	44	149,988
	48	35,910
Direct salaries and wages	17	1,207,793
	18	1,022,289
	35	143,556
	36	110,482
	38	835,731
	40	83,400
Employee *fringe benefits*	12	25,354
	19	202,458
	39	112,769
	45	10,185
	51	59,912
	52	2,627
	60	21,242
	76	185,504
Total labor costs -- 1972		4,702,730

(Cost aggregation)

Source: General Freight Analysis, Fourth Quarter and Twelve Months Cumulative -- 1972, (Washington: American Trucking Associations, 1973), p. 4.

[a]Fourth quarter.
[b]Twelve months cumulative.

EXHIBIT B

FORECAST OF GENERAL FREIGHT RATE INCREASES

This Exhibit, consisting of six (6) Schedules, contains the DS/SD projections of general freight rate increases for Class I railroads, Class I motor carriers and the all-cargo airlines operating on domestic and international routes. All projected freight rate increases have been forecast on a national average basis, i.e., the projected rates of increase by mode are not commodity or territory specific but, rather, reflect the national averages for all commodities and all territories. In addition, the general freight rate increases projected in the following Schedules for the above three modes represent the average rate of increase anticipated for all railroads, motor carriers, and all-cargo airlines regardless of individual carrier class or profitability.

Schedule B-I -- Forecast of Rail Freight Rate Increases. This Schedule develops the average freight rate increases anticipated in rail carload rates for 1977 through 1982.

The criteria used to measure railroad profitability by the railroad industry, the Interstate Commerce Commission (ICC), and financial lending institutions are the rate of return (ROI) carriers receive on investments after deducting operating expenses and taxes. Class I railroads have experienced an average ROI of only 2.6 percent since 1967. Since railroads, as an industry, must compete with other industries for available financial resources, DS/SD has assumed that a long-range ROI of six to ten percent will be required. Therefore, a three (3) percent ROI has been projected for 1976 and 1977. A further improvement is forecasted for 1978 and is expected to continue through the scope of this study at an average annual rate of one-half a percentage point each year. This results in an average ROI of 5.5 percent by 1982.

The net operating revenues, after expenses and taxes, were calculated by multiplying the projected net investment figures by the projected ROI yields indicated. Having calculated the amount of net revenues required, total revenues can be obtained by adding together projected net revenues, operating costs, and taxes.

Schedule B-II -- Forecast of Motor Carrier Freight Rate Increases. This Schedule develops the average freight rate increases anticipated in truckload and less-than-truckload rates for 1977 through 1982. The criteria used to measure motor carrier profitability by the motor carrier industry, the Interstate Commerce Commission (ICC), and financial lending institutions are their operating ratio or the ratio of operating expenses to operating revenues. Class I motor carriers have maintained an average operating ratio of approximately 95.0 for 1967-1973. Comparable figures for 1974 and 1975 were not available. However, the American Trucking Associations have indicated that if comparable 1974

and 1975 figures were available, the overall expected Class I motor carrier operating ratio would be very close to 95. An operating ratio of 95 is considered by most carrier experts as sufficient to attract needed capital since it results in a ten (10) to fifteen (15) percent return on their investments. ROI's of this magnitude have been and are projected to be sufficient to compete with other industries for available financial resources. Therefore, DS/SD has used an overall operating ratio of 95 for purposes of projecting total motor carrier revenue requirements for 1977 through 1982. Total operating revenues were obtained by dividing total projected operating costs by .95. The results of this calculation represent the total operating revenues required to offset costs and maintain an average operating ratio of 95.

Schedule B-III -- Forecast of Airline Freight Rate Increases. This Schedule develops the average freight rate increases anticipated in domestic and international all-cargo airline rates for 1977 through 1982.

The traditional measure of airline profitability has been their rate of return on investment (ROI) after deducting operating expenses and taxes from revenues.

Since the CAB has changed the basis for calculating airline investments several times from 1967 through 1974, investment data were not available on a comparable basis for the base period. Due to the lack of compatible data, DS/SD used the operating ratio (ratio of operating expenses to operating revenues) to measure all-cargo airline profitability.

Domestic all-cargo airlines have maintained an average operating ratio of approximately 102.7 since 1969. Operating expenses, therefore, have been greater than operating revenues and, as a result, domestic all-cargo airlines have not been profitable since 1967. Future prospects do not indicate that all-cargo airlines operating domestic routes will be in a position to make substantial gains in reducing their overall operating ratio below 100. Industry officials generally feel that little can be done to reduce overall operating costs beyond this point since, to a large extent, the per unit cost of labor, fuel, and material and supplies is somewhat fixed, and these costs are largely outside the direct control of the domestic all-cargo airlines. However, it is acknowledged that the industry must improve its operating ratio if it is to remain viable. Given competitive pressures, the improvement is not expected to result from disproportional rate increases. Therefore, DS/SD has calculated domestic all-cargo revenue requirements for 1977 through 1982 based upon an average operating ratio of 100. This assumes that the domestic all-cargo airlines will be able to effect an overall reduction in operating expenses of approximately 2.7 percent. It should be noted that no freight rate increases will be required from this type of operating ratio improvement, since it is anticipated that improvements will result from operating efficiencies rather than from increased revenues. If this should prove not to be the case, additional increases can be expected.

All-cargo U.S. airlines operating international routes have maintained an average operating ratio of approximately 88.1 since 1969. Unlike their domestic counterparts, international all-cargo U.S. airlines have maintained a healthy operating ratio that has enabled them to obtain as much as a fifteen (15) percent return on their investments based upon CAB ROI calculations. In this Schedule DS/SD has used an average operating ratio of 88.1 for purposes of projecting total international all-cargo revenue requirements for 1977 through 1982.

Schedule B-IV -- Forecast of Rail, Motor Carriers, and Airline Tonnages. This Schedule contains the historical and projected tonnage figures for Class I railroads, Class I motor carriers and for all-cargo U.S. airlines operating domestic and international routes. The historical rail and motor carrier tonnage figures were obtained from tonnage statistics published by the Association of American Railroads and the American Trucking Associations. However, similar statistics were not available for the all-cargo airline. Consequently, historical all-cargo airline tonnages were estimated by using the following Civil Aeronautics Board statistics: (1) average tons carried per flight, (2) average haul per flight, and (3) total revenue ton-miles flown. The average tons per flight were multiplied by the average haul per flight to determine the average ton-miles carried per flight. Next, the total revenue ton-miles were divided by the average ton-miles carried per flight to determine the estimated number of flights flown. This figure was then multiplied by the average tons carried per flight to estimate the overall airline tonnage figures shown in this Schedule.

Tonnage projections for 1977 through 1982 were obtained for each mode by applying a linear regression analysis to the historical data. The trends developed by these analyses were then used to forecast the 1977 through 1982 tonnage figures. The historical data base used in these analyses for projecting rail tonnages was the tonnage data for 1967 through 1974. Motor carrier projections were based on 1967 through 1973 data, and airline projections were based on tonnage statistics for 1969 through 1974. The regression analysis for motor carriers did not include 1974 tonnages since these data were not available on a comparable basis with tonnage figures for 1967 through 1973. Tonnage figures for 1967 and 1968 were not included in the domestic and international air regression analyses since the data for these years were compiled on a different basis from those for 1969 through 1974. Prior to 1969, all airline tonnages associated with operating routes from, to, and within Alaska and Hawaii were included with figures for international operations. Separate Alaska and Hawaii data were not available for making the required adjustments so that all tonnage figures for 1967 through 1974 could be derived on a comparable basis. Thus, we excluded 1967 and 1968.

Schedule B-V -- Forecast of Federal, State, Local, and Foreign Railroad Taxes. This Schedule shows the federal, state, local, and foreign tax burden paid by Class I railroads from 1967 through 1974. It also develops this tax burden as a percentage of taxable revenues. The relationship of taxes paid to taxable revenues has remained fairly

stable since 1967 and has been approximately 45 percent of taxable revenues. It is anticipated that this relationship will not be significantly different during the period being forecasted. Thus, DS/SD has used an average tax burden figure of 45 percent of taxable revenues to forecast the federal and state taxes. Total applicable state and federal taxes were calculated by first determining what the total taxable revenues would be if net revenues represented 55 percent of total taxable revenues. Hence, taxable revenues were calculated by dividing the net revenue figures by .55. State and federal taxes can then be obtained by subtracting net revenues from taxable revenues. The results were used in the development of rail freight rate increases in Schedule B-I.

Schedule B-VI -- General Motor Carrier Freight Rate Increases. This Schedule shows the general freight rate increases received by motor carriers from 1970 to 1974. These increases have been calculated on a cumulative percentage basis for three (3) major types of freight categories and for several motor carrier rate territories. The relationship of truckload (TL) to minimum charge (MC) and less-than-truckload (LTL) freight rate increases has been established on an average ratio basis for each motor carrier rate territory. The ratios were obtained by dividing the respective MC and LTL cumulative percentage increases by the corresponding TL increases. DS/SD has combined the MC and LTL types of traffic in this Schedule for purposes of projecting LTL and TL freight rate increases. An average ratio of 1.85 to 1.00 has been used to reflect the resulting combined MC and LTL freight rate increase relationship to TL freight rate increases. This relationship has been used in Schedule B-II -- Forecast of Motor Carrier Freight Rate Increases to prorate projected LTL and TL freight rate increases. This approach was used since sufficient cost data were not available in the right format to prorate the overall projected freight rate increases by type of traffic. Therefore, recognizing that general freight rate increases must be cost justified, we developed this approach. The ratios of MC to TL and LTL to TL freight rate increases developed in Schedule B-VI should approximate the same results that would be obtained if cost data were available.

According to ATA statistics for 1967 through 1973, approximately two thirds (2/3) of total Class I motor carrier revenues are generated from LTL freight while TL freight represents approximately one third (1/3) of total revenues. General freight rate increases can be prorated to LTL and TL traffic by using this relationship along with the LTL to TL freight rate increase ratio of 1.85 to 1.00. Prorated LTL and TL increases can be calculated by using the following two simultaneous linear equations:

1. $2/3x + 1/3y$ = total rate increase.

2. $\frac{x}{y} = 1.85$.

The unknown values for "x" and "y" in the above equations represent the respective LTL and TL relationships mentioned. Solving the above equations for a projected total rate increase of 10 percent results in LTL increases of 11.8 percent and TL increases of 64 percent.

Schedule B-I

Forecast of Rail Freight Rate Increases

	Projected operating statement ($000)						
	1976	1977	1978	1979	1980	1981	1982
Net investment[a]	28,464,690	28,449,552	28,411,136	28,349,442	28,264,470	28,156,219	28,024,690
Operating revenues[b]	17,733,154	19,457,123	20,388,145	21,278,824	22,175,636	23,049,771	23,911,246
Expenses[c]:							
Labor	8,785,313	9,061,176	9,307,990	9,524,825	9,712,585	9,870,394	9,999,100
Fuel	1,481,843	1,633,083	1,747,258	1,855,330	1,985,130	2,118,457	2,265,117
Material and supplies[d]	3,023,171	3,276,926	3,439,810	3,606,574	3,767,764	3,942,111	4,120,337
Depreciation	867,762	874,547	882,729	890,558	907,488	914,788	921,736
Miscellaneous	2,022,445	2,159,596	2,302,376	2,439,759	2,590,122	2,744,365	2,902,487
Total expenses	16,180,534	17,905,328	18,580,163	19,217,046	19,863,089	20,490,115	21,108,777
Revenues before taxes[e]	1,552,620	1,551,795	1,807,982	2,061,778	2,312,547	2,559,656	2,802,469
Federal and states taxes[f]	698,679	698,308	813,592	927,800	1,040,646	1,151,845	1,261,111
Net revenues[g]	853,941	853,487	994,390	1,133,978	1,271,901	1,407,811	1,541,358
ROI (%)[h]	3.0	3.0	3.5	4.0	4.5	5.0	5.5
Tonnage (000 tons)[i]	1,548,352	1,563,629	1,578,906	1,594,183	1,609,460	1,624,737	1,640,014
Revenue per ton ($)[j]	11.45	12.44	12.91	13.34	13.78	14.19	14.58
Percent increase in per ton revenue		8.6	3.8	3.3	3.3	3.0	2.7
Projected increase in freight rates[k]		6.2	6.2	5.2	4.8	4.4	4.1

[a]Based on linear regression analysis of Class I railroad net investments for 1967 through 1974.

[b]Sum of expenses, federal and state taxes and net revenues.

[c]From Schedules C-I, D-I, E-I, F-I, and G-I.

[d]Includes a $1 billion per year adjustment starting in 1977 for rail track improvements.

[e]Sum of net revenues and federal and state taxes.

[f]Based on average federal and state tax burden of 45 percent of taxable revenues as developed in Schedule B-V.

[g]Represents the net revenues required to yield the projected rates of return on net investments.

[h]Return on investments.

[i]From Schedule B-IV.

[j]Operating revenues divided by tonnage.

[k]Freight rate increases were modified to reflect a one-year lag in obtaining the projected increases developed on a per ton revenue basis.

Schedule B-II

Forecast of Motor Carrier Freight Rate Increases

	Projected operating statement ($000)						
	1976	1977	1978	1979	1980	1981	1982
Operating revenues[a]	12,195,442	13,204,747	14,211,877	15,248,214	16,335,971	17,466,216	18,642,131
Expenses[b]:							
Labor	6,745,377	7,303,014	7,882,702	8,485,614	9,109,450	9,755,337	10,423,196
Fuel	1,209,165	1,364,240	1,490,621	1,612,009	1,755,188	1,909,421	2,076,537
Material and supplies	1,694,907	1,814,655	1,937,131	2,063,371	2,193,376	2,327,146	2,464,663
Depreciation	348,219	365,963	383,367	402,123	419,931	437,917	457,387
Miscellaneous	1,588,002	1,696,638	1,807,463	1,922,687	2,041,228	2,163,085	2,288,242
Total expenses	11,585,670	12,544,510	13,501,284	14,485,804	15,519,173	16,592,906	17,710,025
Net revenues before taxes[c]	609,772	660,237	710,593	762,410	816,798	873,310	932,106
Tonnage (000 tons)[d]	240,555	248,276	255,997	263,718	271,439	279,160	286,881
Revenue per ton ($)[e]	50.70	53.19	55.52	57.82	60.18	62.57	64.98
Percent increase in per ton revenue		4.9	4.4	4.1	4.1	4.0	3.9
Projected increase in freight rates[f]							
Less-than-truckload		5.8	5.2	4.8	4.8	4.8	4.6
Truckload		3.1	2.8	2.6	2.6	2.6	2.5

[a] Based on an operating ratio of expenses to revenues of 95.0.

[b] From Schedules C-II, D-II, E-II, F-II and G-II.

[c] Difference between operating revenues and expenses.

[d] From Schedule B-IV.

[e] Operating revenue divided by tonnage.

[f] Less-than-truckload (LTL) and truckload (TL) freight rate increases reflect the following historical LTL and TL relationships:

(1) Two thirds of all operating revenues are derived from LTL freight and one third from TL freight.
(2) LTL rates have increased approximately 1.85 times as fast as TL rates in the past five years (Schedule B-VI).

Schedule B-III

Forecast of Air Freight Rate Increases

	Projected operating statement ($000)						
	1976	1977	1978	1979	1980	1981	1982
Domestic airlines							
Operating revenues[a]	117,575	128,092	138,179	148,345	159,257	170,624	182,511
Expenses[b]:							
Labor	48,330	52,589	57,023	61,620	66,393	71,335	76,439
Fuel	26,789	30,559	33,706	36,749	40,349	44,210	48,409
Material and supplies	4,472	4,891	5,328	5,783	6,256	6,747	7,257
Depreciation	8,515	8,976	9,437	9,898	10,359	10,820	11,281
Miscellaneous	29,469	31,077	32,685	34,295	35,900	37,512	39,125
Total expenses	117,575	128,092	138,179	148,345	159,257	170,624	182,511
Net revenues before taxes[c]	0	0	0	0	0	0	0
Tonnage (000 tons)[d]	408	405	403	401	399	396	394
Revenue per ton ($)	288.2	316.3	342.9	369.9	399.1	430.9	463.2
Percent increase in per ton revenues		9.8	8.4	7.9	7.9	7.9	7.5
Projected increase in freight rates[e]		9.8	8.4	7.9	7.9	7.9	7.5
International airlines							
Operating revenues[a]	332,018	366,520	400,131	434,395	471,301	509,984	550,646
Expenses[b]:							
Labor	112,761	125,423	138,743	152,752	167,435	182,772	198,802
Fuel	70,436	80,401	88,739	96,797	106,324	116,563	127,687
Material and supplies	10,629	11,416	12,241	13,071	13,923	14,814	15,709
Depreciation	17,735	18,708	19,681	20,654	21,627	22,600	23,573
Miscellaneous	80,947	86,956	93,111	99,428	105,907	112,547	119,348
Total expenses	292,508	322,904	352,515	382,702	415,216	449,296	485,119
Net revenues before taxes[c]	39,510	43,616	47,616	51,693	56,085	60,688	65,527
Tonnage (000 tons)[d]	713	715	717	719	721	724	726
Revenue per ton ($)	465.7	512.6	558.1	604.2	653.7	704.4	758.5
Percent increase in per ton revenue		10.1	8.9	8.3	8.2	7.8	7.7
Projected increase in freight rates[e]		10.1	8.9	8.3	8.2	7.8	7.7

[a] Based on an operating ratio of expenses to revenues of 1.00 for domestic air and 88.1 for international air.
[b] From Schedules C-III, D-III, E-III, F-III, and G-III.
[c] Difference between operating revenue and expenses.
[d] From Schedule B-IV.
[e] Freight rate increases based on per ton revenue increases.

Schedule B-IV

Forecast of Rail, Motor Carrier, and Airline Tonnages
(Thousands of revenue tons originated)

History file	Rail[a]	Motor[b]	Air[c] Domestic	Air[c] International[g]
1967	1,407,628	169,994	727	481
1968	1,431,308	183,617	645	543
1969	1,473,457	199,539	608	826
1970	1,484,919	182,603	315	737
1971	1,390,960	190,608	288	846
1972	1,447,864	205,070	335	819[e]
1973	1,532,165	230,731	470[d]	671[e]
1974	1,543,300	N/A	490[d]	632[e]
Forecast[f]				
1977	1,563,629	248,276	405	715
1978	1,578,906	255,997	403	717
1979	1,594,183	263,718	401	719
1980	1,609,460	271,439	399	721
1981	1,624,737	279,160	396	724
1982	1,640,014	286,881	394	726

N/A -- not available

[a] Yearbook of Railroad Facts -- 1975, p. 28.

[b] General Freight Analysis, fourth quarter and twelve months cumulative (1967-1973).

[c] Based on Tables 12 and 15 of Handbook of Airline Statistics, Part III.

[d] Based on Air Carriers Traffic Statistics, December 1974, p. 12.

[e] Ibid, p. 15.

[f] The linear regression method was used to forecast rail, motor and domestic air tonnages.

[g] The international air forecast has been modified by DS/SD and does not reflect a linear projection of past tonnage performance.

Schedule B-V

Forecast of Federal, State, Local and Foreign Railroad Taxes (Class I railroads)

Year	Taxable revenues[b]	Taxes paid[a] -- ($000)				Total taxes as percent of taxable revenues
		Federal	State and local	Foreign	Total	
1967	1,109,474	67,197	363,029	2,814	433,040	39.03
1968	1,111,260	66,896	363,650	3,091	433,637	39.02
1969	1,150,806	107,065	385,540	3,531	496,136	43.11
1970	978,461	89,370	399,435	3,803	492,608	50.35
1971	1,106,731	108,608	399,971	2,981	511,560[c]	46.22
1972	1,174,452	113,869	404,277	2,479	520,625[c]	44.33
1973	1,192,647	130,720	408,714	3,385	542,819[c]	45.51
1974	1,429,673	216,882	441,210	3,475	661,567[c]	46.27
Total	9,253,504	900,607	3,165,826	25,559	4,091,992	44.22

[a] Statistics of Railroads of Class I, p. 13.
[b] Ibid.
[c] Excludes provisions for deferred taxes.

Schedule B-VI

General Motor Carrier Freight Rate Increases

1970-1974

(Cumulative increases)

Motor carrier rate bureaus	Year	Type of traffic: Truckload increases	Less-than-truckload increases	Ratio to truckload increases	Minimum charge increases	Ratio to truckload increases
New England	1970	5.00	11.18	2.24	15.54	3.11
	1971	11.38	24.88	2.19	29.77	2.62
	1972	14.75	35.05	2.38	41.03	2.78
	1973	17.04	43.27	2.54	48.08	2.82
	1974	27.67	59.37	2.15	64.73	2.34
Eastern Central	1970	7.10	10.16	1.43	10.16	1.43
	1971	14.73	22.61	1.53	27.28	1.85
	1972	17.02	26.29	1.54	31.73	1.86
	1973	22.34	33.96	1.52	42.47	1.90
	1974	37.46	50.52	1.35	60.08	1.60
Middle Atlantic	1970	8.12	11.18	1.38	11.18	1.38
	1971	14.69	23.74	1.62	23.74	1.62
	1972	17.00	33.20	1.95	34.48	2.03
	1973	25.99	45.53	1.75	51.34	1.98
	1974	39.47	61.11	1.55	67.54	1.71
Middlewest and Southwest	1970	6.00	13.53	2.26	17.98	3.00
	1971	9.74	27.55	2.83	32.55	3.34
	1972	11.39	35.97	3.16	41.30	3.63
	1973	15.88	46.34	2.92	52.08	3.28
	1974	30.19	64.43	2.13	70.88	2.35
Southern	1970	5.06	8.15	1.61	8.15	1.61
	1971	9.29	24.98	2.69	24.98	2.69
	1972	11.48	31.95	2.78	31.95	2.78
	1973	17.12	42.70	2.49	42.70	2.49
	1974	28.64	58.49	2.04	58.49	2.04
Average cumulative increase for rate bureaus -- 1970-1974.		32.69	58.06	1.78	64.34	1.97

Source: All freight rate increases were obtained from the respective motor carrier rate bureaus listed.

EXHIBIT C

FORECAST OF LABOR COSTS

This Exhibit, consisting of three (3) Schedules, projects total labor costs for Class I railroads and motor carriers and for all-cargo U.S. airlines operating domestic and international routes. Labor costs, as developed in the following Schedules, include total salaries and wages, fringe benefits, and payroll taxes.

Schedule C-I -- Forecast of Rail Labor Costs. This Schedule contains the historical and projected labor costs for Class I railroads in the United States. Also included in this Schedule are the historical and projected figures for revenue ton-miles, labor costs per ton-mile, number of employees, and average annual earnings per employee.

The development of total labor costs was obtained by multiplying the number of employees by their average annual earnings. Projected employee and earnings figures were calculated by applying a linear regression analysis to the base period data. The results of this analysis were then used to develop the forecast for 1977 through 1982.

Revenue ton-miles were also calculated by using a linear regression analysis and projecting the trend developed by this analysis for 1977 through 1982.

Labor costs per revenue ton-mile were obtained by dividing total labor costs by revenue ton-miles.

Schedule C-II -- Forecast of Motor Carrier Labor Costs. This Schedule contains the historical and projected labor costs for Class I motor carriers in the United States, as well as the historical and projected figures for revenue ton-miles, labor costs per ton-mile, number of employees, and average annual earnings per employee.

The development of total labor costs was obtained by multiplying the projected labor costs per revenue ton-mile by the forecasted revenue ton-miles. Projected figures for labor costs per revenue ton-mile and revenue ton-miles were calculated by applying a linear regression analysis to the base period data for each of these elements. The results of this analysis were then used to develop the forecast for 1977 through 1982. Projected average annual earnings per employee for 1977 through 1982 were also calculated using the linear regression method. The number of employees was then estimated by dividing the total labor costs by the projected average annual earnings per employee.

Schedule C-III -- Forecast of Airline Labor Costs. This Schedule contains the historical and projected labor costs for all-cargo U.S. airlines operating in the United States and on an international basis, as well as the historical and projected figures for revenue ton-miles, labor cost per revenue ton-mile, number of employees, and average annual earnings per employee.

The development of total labor costs was obtained by multiplying the projected labor costs per revenue ton-mile by the forecasted revenue ton-miles. Projected figures for labor costs per revenue ton-mile and revenue ton-miles to be handled were calculated by applying a linear regression analysis to the 1969 through 1974 data for each of these elements. The results of these analyses were then used to develop the forecast for 1977 through 1982. Projected average annual earnings per employee for 1977 through 1982 were also calculated using the linear regression method. The number of employees was then estimated by dividing the total labor costs by the average annual earnings per employee.

Data for 1967 and 1968 were not included in the above regression analysis because these data were compiled on a different basis from the figures obtained for 1969 through 1974. Prior to 1969, all labor costs, associated with operating from, to, or within Alaska and Hawaii were treated as international costs. Starting in 1969, these costs were treated as domestic labor costs. Separate figures cannot be identified in the international cost for Alaska and Hawaii for the period 1967 and 1968. Therefore, the 1967-1968 data could not be adjusted on a comparable basis with 1969 through 1974 figures.

Schedule C-I

Forecast of Rail Labor Costs[a] (Class I railroads)

	Elements				
History file	No. employees[b]	Average annual earnings[c] ($)	Labor costs[d] ($000)	Revenue ton-miles[e] (000,000)	Labor cost per revenue ton-mile (cents)
1967	610,191	8,759	5,344,759	719,498	.743
1968	590,536	9,454	5,582,768	744,023	.750
1969	578,277	10,101	5,841,134	767,841	.761
1970	566,282	11,036	6,249,700	764,809	.817
1971	544,333	11,920	6,488,452	739,743	.877
1972	526,061	13,395	7,046,642	776,746	.907
1973	520,153	15,152	7,881,198	851,809	.925
1974	525,177	16,370	8,597,263	853,887	1.007
Forecast[f]					
1977	471,200	19,230	9,061,176	892,395	1.015
1978	457,800	20,332	9,307,990	910,030	1.023
1979	444,400	21,433	9,524,825	927,665	1.027
1980	431,000	22,535	9,712,585	945,300	1.027
1981	417,600	23,636	9,870,394	962,935	1.025
1982	404,200	24,738	9,999,100	980,570	1.020

[a] Includes fringe benefits.

[b] Yearbook of Railroad Facts -- 1975, p.58.

[c] Labor costs divided by number of employees.

[d] Statistics of Railroads Class I in the United States, p. 12. Includes total salaries and wages, health and welfare, and payroll taxes.

[e] Yearbook of Railroad Facts -- 1975, p. 29.

[f] Forecast based on linear regression analyses of employees, revenue ton-miles, and average annual earnings.

Schedule C-II

Forecast of Motor Carrier Labor Costs[a] (Class I motor carriers)

History file	Elements: No. employees[b]	Average annual earnings[c] ($)	Labor costs[d] ($000)	Revenue ton-miles[d] (000,000)	Labor cost per revenue ton-mile (cents)
1967	320,455	8,672	2,778,982	62,635	4.437
1968	342,216	9,287	3,178,160	70,075	4.535
1969	354,662	9,906	3,513,279	77,005	4.562
1970	341,358	10,428	3,559,677	71,914	4.950
1971	353,530	11,589	4,097,058	77,185	5.308
1972	367,918	12,782	4,702,730	84,864	5.541
1973	377,068	14,583	5,498,783	94,547	5.816
1974	N/A	N/A	N/A	N/A	N/A
Forecast[e]					
1977	413,722	17,652	7,303,014	108,273	6.745
1978	423,915	18,595	7,882,702	112,755	6.991
1979	434,313	19,538	8,485,614	117,237	7.238
1980	444,776	20,481	9,109,450	121,719	7.484
1981	455,346	21,424	9,755,337	126,201	7.730
1982	466,008	22,367	10,423,196	130,682	7.976

N/A -- not available

[a] Includes fringe benefits.

[b] Estimated by dividing total labor costs by average annual earnings.

[c] American Trucking Trends -- 1974, p. 33.

[d] General Freight Analysis, fourth quarter and twelve months cumulative, 1967-1973.

[e] Forecast based on linear regression analyses of earnings, revenue ton-miles, and labor cost per revenue ton-mile.

Schedule C-III

Forecast of Airline Labor Costs[a] (All-cargo carriers)

Domestic airlines

History file	Elements				Labor cost per revenue ton-mile (cents)
	No. employees[b]	Average annual earnings[c] ($)	Labor costs[d] ($000)	Revenue ton-miles[e] (000)	
1967	3,373	10,464	35,299	519,480	6.795
1968	3,344	11,176	37,373	494,181	7.563
1969	2,701	12,189	32,922	474,663	6.936
1970	1,520	13,805	20,981	301,453	6.960
1971	1,487	15,000	22,312	310,878	7.177
1972	1,690	16,557	27,985	378,718	7.389
1973	2,217	17,554[g]	38,911	534,072[f]	7.286
1974	2,386	19,338[g]	46,144	533,176[f]	8.655
Forecast[h]					
1977	2,255	23,325	52,589	588,572	8.935
1978	2,308	24,712	57,023	618,808	9.215
1979	2,361	26,099	61,620	649,044	9.494
1980	2,416	27,486	66,393	679,280	9.774
1981	2,471	28,873	71,335	709,516	10.054
1982	2,526	30,261	76,439	739,752	10.333

International airlines

History file	Elements: No. employees[b]	Average annual earnings[c] ($)	Labor costs[d] ($000)	Revenue ton-miles[e] (000)	Labor cost per revenue ton-mile (cents)
1967	4,144	10,464	43,363	588,545	7.368
1968	3,743	11,176	41,835	674,127	6.206
1969	4,042	12,189	49,272	1,093,261	4.507
1970	4,677	13,805	64,572	1,122,874	5.751
1971	4,343	15,000	65,206	1,263,775	5.160
1972	4,565	16,557	75,586	1,332,555	5.672
1973	4,117	17,554[g]	72,262	1,138,973[f]	6.344
1974	3,991	19,338[g]	77,176	1,112,518[f]	6.937
Forecast[h]					
1977	5,377	23,325	125,423	1,568,180	7.998
1978	5,614	24,712	138,743	1,649,737	8.410
1979	5,853	26,099	152,752	1,731,294	8.823
1980	6,092	27,486	167,435	1,812,851	9.236
1981	6,330	28,873	182,772	1,894,408	9.648
1982	6,570	30,261	198,802	1,975,965	10.061

[a]Includes fringe benefits.

[b]Estimated by dividing total labor costs by average annual earnings.

[c]Handbook of Airline Statistics -- 1973, Part VII, Table 16, p. 464.

[d]Source: For 1967 and 1968 data -- individual all-cargo reports filed with the Civil Aeronautics Board on CAB Form 41. For 1969 through 1974 data -- CAB matrix of airline cost elements.

[e]Handbook of Airline Statistics -- 1973, Part II, Table 4, p. 12, 1967-1972.

[f]Air Carrier Traffic Statistics; December 1973 and 1974, p. 12 for domestic all-cargo and p. 15 for international all-cargo.

[g]Mr. Frank M. Lewis, Bureau of Accounts and Statistics, Civil Aeronautics Board, Washington, D.C.

[h]Forecast based on linear regression analyses of average annual earnings, revenue ton-miles and labor costs per revenue ton-mile.

EXHIBIT D

FORECAST OF FUEL COSTS

This Exhibit, consisting of four (4) Schedules, projects fuel costs for Class I railroads and motor carriers and for all-cargo U.S. airlines operating domestic and international routes. The fuel costs as developed in Schedules D-I, D-II, and D-III include the direct cost of fuel and oil and taxes paid on fuel and oil.

Carrier fuel costs during the later years of our historical data were very erratic due to the 1973 and 1974 Middle East oil embargos. A linear projection of future fuel costs, based on the overall fuel cost experienced during 1967 through 1974, would not result in reliable data. It was necessary therefore to modify our projections, taking into account the effects of the 1973-1974 oil embargos on future fuel prices and availability. DS/SD has based its projected fuel costs on the fuel cost index developed in Schedule D-IV -- Forecast of Fuel Cost Adjustment. This index is based upon a ten-year Federal Aviation Administration (FAA) forecast of crude oil prices for Fiscal Years 1977 through 1987.

Schedule D-I -- Forecast of Rail Fuel Costs. This Schedule contains the historical and projected fuel costs for Class I railroads. It also includes historical and projected figures for revenue ton-miles carried and fuel costs on a revenue per ton-mile basis.

Fuel costs per revenue ton-mile for 1967 through 1974 were obtained by dividing total fuel costs by the revenue ton-miles handled. The revenue per ton-mile figure for 1975 is based upon estimates furnished by the Association of American Railroads (AAR).

Forecasted fuel costs for 1977 through 1982 were calculated by multiplying the projected fuel cost per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected revenue ton-mile costs were obtained by applying the fuel index developed in Schedule D-IV to the base 1975 fuel cost per revenue ton-mile resulting from AAR estimates.

Projected revenue ton-miles were obtained by applying a linear regression analysis to the historical revenue ton-mile data. The results of this analysis were then used to project the 1977 through 1982 revenue ton-mile figures.

Schedule D-II -- Forecast of Motor Carrier Fuel Costs. This Schedule contains the historical and projected fuel costs for Class I motor carriers. In addition, this Schedule also contains historical and projected data for revenue ton-miles carried and fuel cost on a revenue per ton-mile basis.

Total fuel costs for 1967 through 1973 were obtained by combining the direct fuel and oil costs with fuel and oil taxes. Actual fuel

costs for 1974 and 1975 were not available. For estimating purposes, it was assumed that motor carrier fuel increases for 1974 and 1975 would be similar to those experienced by the Class I railroads. During this period, rail fuel costs were up approximately 94 percent for 1974 over 1973 and 18 percent for 1975 over 1974 prices. These percentages were applied to the motor carrier fuel cost for estimating the 1974 and 1975 fuel costs.

Forecasted fuel costs for 1977 through 1982 were calculated by multiplying the projected fuel costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying the fuel index developed in Schedule D-IV to the base 1975 fuel cost per revenue ton-mile.

Projected revenue ton-miles were obtained by applying a linear regression analysis to the historical revenue ton-mile data for 1967 through 1973. The results of this analysis were then used to project the 1977 through 1982 revenue ton-mile figures.

Schedule D-III -- Forecast of Airline Fuel Costs. This Schedule contains the historical and projected fuel costs for all-cargo U.S. airlines operating domestic and international routes as well as historical and projected data for revenue ton-miles carried and fuel cost on a revenue per ton-mile basis.

Total fuel costs for 1967 through 1974 were obtained by combining the direct fuel and oil costs with fuel and oil taxes. Actual fuel costs for 1975 were not available and were estimated based on Civil Aeronautics Board (CAB) estimation.

Forecasted fuel costs for 1977 through 1982 were calculated by multiplying the projected fuel costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying the fuel index developed in Schedule D-IV to the base 1975 fuel costs per revenue ton-mile.

Projected revenue ton-miles were obtained by applying a linear regression analysis to the historical revenue ton-mile data. The results of this analysis were then used to project the 1977 through 1982 revenue ton-mile figures.

Schedule D-IV -- Forecast of Fuel Cost Adjustment. This Schedule contains a forecast of crude oil prices by the Federal Aviation Administration (FAA) for 1976 through 1987. A fuel cost index has been calculated by using the price per barrel of crude oil for 1975 as a base or equal to an index of 100. The resulting indexes for 1976 through 1985 were obtained by dividing the projected cost of crude oil by the base 1975 price of crude oil, i.e., 1976 equals an index of 107.2 ($10.66 ÷ $9.94), and 1977 equals an index of 116.0 ($11.53 ÷ $9.94), etc.

The fuel cost index developed in this Schedule was used to project the full costs for Class I railroads and motor carriers and all-cargo airlines operating domestic and international routes. These costs are further detailed in Schedules D-I, D-II, and D-III.

Schedule D-I

Forecast of Rail Fuel Costs[a] (Class I railroads)

History file	Elements: Fuel and oil ($000)	Elements: Taxes on fuel and oil ($000)	Elements: Total fuel costs[b] ($000)	Revenue ton-miles[c] (000,000)	Fuel costs per ton-mile (¢)	Fuel index[g]
1967	N/A	N/A	398,946	719,498	.055	34.8
1968	N/A	N/A	416,155	744,023	.056	35.4
1969	N/A	N/A	430,017	767,841	.056	35.4
1970	N/A	N/A	435,657	764,809	.057	36.1
1971	N/A	N/A	446,553	739,743	.060	38.0
1972	N/A	N/A	469,127	776,746	.060	38.0
1973	N/A	N/A	587,655	851,809	.069	43.7
1974	N/A	N/A	1,142,292	853,887	.134	84.8
1975	N/A	N/A	1,354,258[e]	857,125[f]	.158[e]	100.0
Forecast[d]						
1977	N/A	N/A	1,633,083	892,395	.183	116.0
1978	N/A	N/A	1,747,258	910,030	.192	121.7
1979	N/A	N/A	1,855,330	927,665	.200	126.5
1980	N/A	N/A	1,985,130	945,300	.210	132.7
1981	N/A	N/A	2,118,457	962,935	.220	139.2
1982	N/A	N/A	2,265,117	980,570	.231	146.2

N/A -- not available

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[a] Includes taxes paid on fuel and oil.

[b] Statistics of Railroads of Class I, p. 12.

[c] Yearbook of Railroad Facts -- 1975, p. 29.

[d] Forecast based on fuel index developed in Schedule D-IV and straight-line regression analysis of revenue ton-miles.

[e] Estimated based on Association of American Railroad estimates that fuel costs were up approximately 18.2 percent over 1974 levels.

[f] Based on linear regression analysis of revenue ton-miles 1967-1974.

[g] See Schedule D-IV.

Schedule D-II

Forecast of Motor Carrier Fuel Costs (Class I motor carriers)

	Elements				
History file	Fuel and oil ($000)	Taxes on fuel and oil ($000)	Total fuel costs ($000)	Revenue ton-miles (000,000)	Fuel costs per ton-mile (cents)
1967	127,986	114,126	242,112	62,635	.387
1968	151,164	132,553	283,717	70,075	.405
1969	166,250	143,379	309,629	77,005	.402
1970	160,262	139,288	299,550	71,914	.417
1971	175,250	149,774	325,024	77,185	.421
1972	193,695	169,409	363,104	84,864	.428
1973	260,523	187,903	448,426	94,547	.474
1974	N/A	N/A	872,408[a]	94,827[b]	.920[a]
1975	N/A	N/A	1,079,489[a]	99,309[b]	1.087[a]
Forecast[c]					
1977			1,364,240	108,273	1.260
1978			1,490,621	112,755	1.322
1979			1,612,009	117,237	1.375
1980			1,755,188	121,719	1.442
1981			1,909,421	126,201	1.513
1982			2,076,537	130,682	1.589

N/A -- not available

Source: General Freight Analysis, fourth quarter and twelve months cumulative, 1967-1973.

[a]Estimated using fuel cost increases experienced by railroads from 1973 to 1975. Rail fuel costs in 1974 were up approximately 94 percent over 1973 and up approximately 18 percent in 1975 over 1974 levels.

[b]Based on linear regression analysis of revenue ton-miles using 1967 through 1973 data.

[c]Forecast based on fuel index developed in Schedule D-IV and linear regression analysis of revenue ton-miles.

Schedule D-III

Forecast of Airline Fuel Costs (All-cargo carriers)

Domestic airlines

History file	Elements[a] Fuel and oil ($000)	Taxes on fuel and oil ($000)	Total fuel costs ($000)	Revenue ton-miles[b] (000)	Fuel costs per ton-mile (cents)
1967	22,830	824	23,654	519,480	4.553
1968	21,909	854	22,763	494,181	4.606
1969	12,185	524	12,709	474,663	2.677
1970	7,040	482	7,522	301,453	2.495
1971	6,908	126	7,034	310,878	2.263
1972	8,115	54	8,169	378,718	2.157
1973	12,345	104	12,449	534,072[c]	2.331
1974	24,635	184	24,819	533,176[c]	4.655
1975	N/A	N/A	23,639[e]	528,100[f]	4.476[e]
Forecast[d]					
1977			30,559	588,572	5.192
1978			33,706	618,808	5.447
1979			36,749	649,044	5.662
1980			40,349	679,280	5.940
1981			44,210	709,516	6.231
1982			48,409	739,752	6.544

International airlines

History file	Elements[a] Fuel and oil ($000)	Taxes on fuel and oil ($000)	Total fuel costs ($000)	Revenue ton-miles[b] (000)	Fuel costs per ton-mile (cents)
1967	31,058	199	31,257	588,545	5.311
1968	28,303	101	28,404	674,127	4.213
1969	27,132	539	27,671	1,093,261	2.531
1970	25,997	1,086	27,083	1,122,874	2.412
1971	26,419	673	27,092	1,263,775	2.144
1972	28,187	653	28,840	1,332,555	2.164
1973	27,291	422	27,713	1,138,973[c]	2.433
1974	56,622	806	57,428	1,112,518[c]	5.162
1975	N/A	N/A	62,104[e]	1,405,070[f]	4.420[e]
Forecast[d]					
1977			80,401	1,568,180	5.127
1978			88,739	1,649,737	5.379
1979			96,797	1,731,294	5.591
1980			106,324	1,812,851	5.865
1981			116,563	1,894,408	6.153
1982			127,687	1,975.965	6.462

N/A -- not available

[a] Source: For 1967 and 1968 elements -- individual all-cargo reports filed with the Civil Aeronautics Board on CAB Form 41. For 1969 through 1974 elements -- CAB matrix of airline cost elements.

[b] Handbook of Airline Statistics -- 1973, Part II, Table 4, p. 12.

[c] Air Carrier Traffic Statistics, December 1973 and December 1974, pp. 12 and 15.

[d] Forecast based on fuel index developed in Schedule D-IV and linear regression analysis of revenue ton-miles.

[e] Estimated based on Civil Aeronautics Board estimates of fuel consumption and cost of fuel per gallon for 1975.

[f] Based on linear regression analysis of revenue ton-miles.

Schedule D-IV

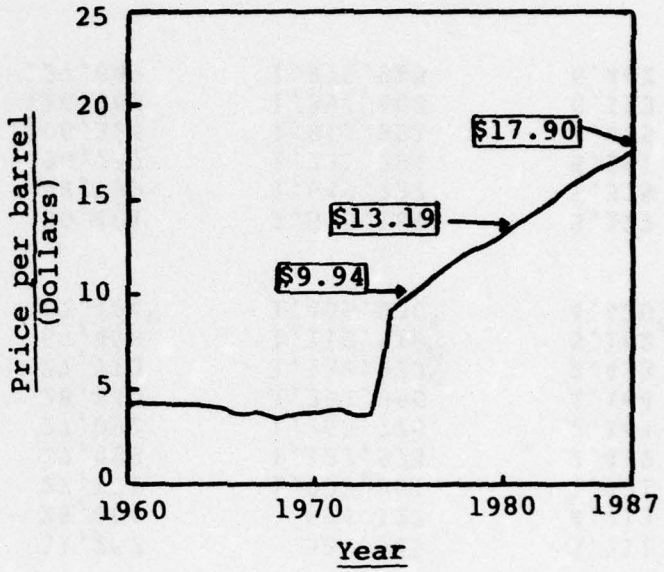
Forecast of Fuel Cost Adjustment

Prices 1975-1985 (per barrel)

Index of fuel and oil costs

Year	Crude oil prices ($)	Index (1975 = 100)
1975	9.94	100.0
1976	10.66	107.2
1977	11.53	116.0
1978	12.10	121.7
1979	12.57	126.5
1980	13.19	132.7
1981	13.84	139.2
1982	14.53	146.2
1983	15.25	153.4
1984	16.01	161.1
1985	16.81	169.1

Cost of crude oil



Source: Office of Aviation Policy. Conference on Aviation Forecasts, Fiscal Years 1977-1987. Washington: Federal Aviation Administration, 1975.

EXHIBIT E

FORECAST OF MATERIAL AND SUPPLIES COSTS

This Exhibit, consisting of three (3) Schedules, projects material and supplies costs, other than fuel and oil, for Class I railroads and motor carriers and for all-cargo U.S. airlines that operate domestic and international routes.

Schedule E-I -- Forecast of Rail Material and Supplies Costs. This Schedule contains the historical and projected material and supplies costs for Class I railroads. It also includes historical and projected figures for revenue ton-miles carried and material and supplies costs per revenue ton-mile.

Forecasted material and supplies costs were obtained by multiplying the projected material and supplies cost per ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying a linear regression analysis to the historical 1967 through 1974 data. The results of this analysis were then used to project the 1977 through 1982 material and supplies costs per revenue ton-mile.

Projected revenue ton-mile figures were obtained by applying the linear regression method to the historical revenue ton-mile data for 1967 through 1974.

Schedule E-II -- Forecast Motor Carrier Material and Supplies Costs. This Schedule contains the historical and projected material and supplies costs for Class I motor carriers, as well as the same type of data for revenue ton-miles and material and supplies costs per revenue ton-mile.

Projected material and supplies costs were obtained by multiplying the projected material and supplies costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying a linear regression analysis to the historical 1967 through 1973 revenue ton-mile data. The results of this analysis were then used to project the 1977 through 1982 costs per revenue ton-mile.

Projected revenue ton-miles were obtained by applying the linear regression method to the historical revenue ton-mile data for 1967 through 1973.

Schedule E-III -- Forecast of Airline Material and Supplies Costs. This Schedule contains the historical and projected material and supplies costs for all-cargo U.S. airlines operating domestic and international routes, as well as historical and projected revenue ton-mile and material and supplies costs per revenue ton-mile data.

The historical material and supplies costs for 1967 and 1968 were compiled from individual all-cargo carrier reports filed by the carriers with the Civil Aeronautics Board (CAB). Material and supplies costs for 1969 through 1974 were taken from an internal CAB cost summary report. This report was started in 1969 and combines various operating costs by type of carrier.

Forecasted material and supplies costs were calculated by multiplying the projected material and supplies costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying a linear regression analysis to the historical 1969 through 1974 revenue ton-mile data. The results of this analysis were then used to project these costs for 1977 through 1982. Data for 1967 and 1968 were excluded in the regression analysis because these data were compiled on a different basis from the figures for 1969 through 1974. Prior to 1969, all costs associated with operating from, to and within Alaska and Hawaii were treated as international costs. Starting in 1969 these costs were treated as domestic costs. Separate figures cannot be identified in the international cost for Alaska and Hawaii for the period 1967 and 1968. Therefore, the 1967-1968 data could not be adjusted on a comparable basis as data for 1969 through 1974.

Projected revenue ton-mile figures were obtained by applying the linear regression method to the 1969 through 1974 revenue ton-mile data and projecting the results of this analysis for 1977 through 1982.

Schedule E-I

Forecast of Rail Material and Supplies Costs (Other than fuel) (Class I railroads)

History file	Material and supplies ($000)	Revenue ton-miles[b] (000,000)	Material and supplies expense per revenue ton-mile (cents)
1967	1,790,962	719,498	.249
1968	1,916,290	744,023	.258
1969	2,063,494	767,841	.269
1970	2,222,046	764,809	.291
1971	2,317,956	739,743	.313
1972	2,259,436	776,746	.291
1973	2,459,052	851,809	.289
1974	2,920,977	853,887	.342
Forecast[c]			
1977	3,176,926	892,395	.356
1978	3,339,810	910,030	.367
1979	3,506,574	927,665	.378
1980	3,667,764	945,300	.388
1981	3,842,111	962,935	.399
1982	4,020,337	980,570	.410

[a] Statistics of Railroads of Class I, p. 12.

[b] Yearbook of Railroad Facts -- 1975, p. 29.

[c] Forecast based on linear regression analyses of revenue ton-miles and material and supplies expense per revenue ton-mile.

Schedule E-II

Forecast of Motor Carrier Material and Supplies Costs (Other than fuel) (Class I motor carriers)

History file	Material and supplies ($000)	Revenue ton-miles (000,000)	Material and supplies expense per revenue ton-mile (cents)
1967	778,784	62,635	1.243
1968	905,006	70,075	1.292
1969	1,002,554	77,005	1.302
1970	1,030,055	71,914	1.432
1971	1,131,830	77,185	1.466
1972	1,248,683	84,864	1.471
1973	1,381,823	94,547	1.462
1974	N/A	N/A	N/A
Forecast[a]			
1977	1,814,655	108,273	1.676
1978	1,937,131	112,755	1.718
1979	2,063,371	117,237	1.760
1980	2,193,376	121,719	1.802
1981	2,327,146	126,201	1.844
1982	2,464,663	130,682	1.885

N/A -- not available

Source: General Freight Analysis, fourth quarter and twelve months cumulative, 1967-1973.

[a]Forecast based on linear regression analyses of revenue ton-miles and material and supplies expense per revenue ton-mile.

Schedule E-III

Forecast of Airline Material and Supplies Costs (Other than fuel)
(All-cargo carriers)

Domestic airlines

History file	Material and supplies[a] ($000)	Revenue ton-miles[b] (000)	Material and supplies expense per revenue ton-mile (cents)
1967	5,341	519,480	1.028
1968	5,548	494,181	1.123
1969	3,302	474,663	.696
1970	1,721	301,453	.571
1971	1,928	310,878	.620
1972	2,286	378,718	.604
1973	3,384	534,072[c]	.634
1974	4,645	533,176[c]	.871
Forecast[d]			
1977	4,891	588,572	.831
1978	5,328	618,808	.861
1979	5,783	649,044	.891
1980	6,256	679,280	.921
1981	6,747	709,516	.951
1982	7,257	739,752	.981

International airlines

History file	Material and supplies[a] ($000)	Revenue ton-miles[b] (000)	Material and supplies expense per revenue ton-mile (cents)
1967	4,317	588,545	.734
1968	4,059	674,127	.602
1969	6,382	1,093,261	.584
1970	8,466	1,122,874	.754
1971	7,637	1,263,775	.604
1972	7,570	1,332,555	.568
1973	7,973	1,138,973[c]	.700
1974	7,974	1,112,518[c]	.717
Forecast[d]			
1977	11,416	1,568,180	.728
1978	12,241	1,649,737	.742
1979	13,071	1,731,294	.755
1980	13,923	1,812,851	.768
1981	14,814	1,894,408	.782
1982	15,709	1,975,965	.795

[a]Source: For 1967 and 1968 data -- individual all-cargo reports filed with the Civil Aeronautics Board on CAB Form 41. For 1969 through 1974 data -- CAB matrix of airline cost elements.

[b]Handbook of Airline Statistics -- 1973, Part II, Table 4, p. 12.

[c]Air Carrier Traffic Statistics, December 1973 and December 1974, pp. 12 and 15.

[d]Forecast based on linear regression analyses of revenue ton-miles and material and supplies expense per revenue ton-mile.

EXHIBIT F

FORECAST OF DEPRECIATION COSTS

This Exhibit, consisting of three (3) Schedules, projects the depreciation costs for Class I railroads and motor carriers and for all-cargo U.S. airlines operating domestic and international routes. The depreciation costs developed in the following Schedules include both the depreciation and amortization expenses associated with the acquisition and depletion of assets.

Schedule F-I -- Forecast of Rail Depreciation Costs. This Schedule contains the historical and projected depreciation costs for Class I railroads. It also includes historical and projected figures for revenue ton-miles and depreciation costs on a revenue ton-mile basis.

The depreciation costs developed in this Schedule include the expenses associated with depreciation and amortization and the retirement of equipment that is no longer useful to railroad operations.

Forecasted depreciation costs were calculated by multiplying the projected depreciation cost per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying a linear regression analysis to the 1967 through 1974 historical cost per ton-mile data. The results of this analysis were then used to project the revenue per ton-mile cost figures for 1977 through 1982.

Projected revenue ton-mile figures were obtained by applying the linear regression method to the historical revenue ton-mile data.

Schedule F-II -- Forecast of Motor Carrier Depreciation Costs. This Schedule contains the historical and projected depreciation costs for Class I motor carriers, as well as historical and projected figures for revenue ton-miles and depreciation costs on a revenue ton-mile basis.

Forecasted depreciation costs were calculated by multiplying the projected depreciation cost per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying a linear regression analysis to the historical 1967 through 1973 data. The results of this analysis were then used to calculate the projected costs for 1977 through 1982.

Projected revenue ton-mile figures were obtained by applying the linear regression method to the revenue ton-mile data for 1967 through 1973 and using the results to obtain figures for 1977 through 1982.

Schedule F-III -- Forecast of Airline Depreciation Costs. This Schedule contains the historical and projected depreciation costs for all-cargo U.S. airlines that operate domestic and international routes.

The historical depreciation costs for 1967 and 1968 were compiled from individual all-cargo carrier reports filed with the Civil Aeronautics Board (CAB). Depreciation costs for 1969 through 1974 were taken from an internal CAB cost summary report. This report was started in 1969 and combines various operating costs by function and type of carrier.

Forecasted depreciation costs were calculated by multiplying the projected depreciation costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected depreciation costs per revenue ton-mile were based on the average cost per revenue ton-mile experienced from 1969 through 1974. A linear regression analysis was also used on these data; however, the results of this analysis were inconclusive. Consequently, it was not used to project realistic depreciation costs.

The averaging method was used to calculate the projected depreciation costs per revenue ton-mile because this method tends to best smooth out the erratic fluctuations in costs that took place during 1969 to 1974.

Data for 1967 and 1968 were excluded from computing the average depreciation costs per revenue ton-mile because these data were compiled on a different basis from the figures for 1969 through 1974. Prior to 1969, all costs associated with operating from, to, or within Alaska and Hawaii were treated as international costs. Starting in 1969 these costs were treated as domestic costs. Separate figures cannot be identified in the international cost for Alaska and Hawaii for the period 1967 and 1968. Therefore, the 1967-1968 data could not be adjusted on a comparable basis as data for 1969 through 1974.

Projected revenue ton-miles were obtained by applying a linear regression analysis to the historical 1969 through 1974 revenue ton-mile data. The results of this analysis were then used to project the 1977 through 1982 revenue ton-miles to be carried. Data for 1967 and 1968 were not included in this analysis because of the Hawaii and Alaska situation mentioned above.

Schedule F-I

Forecast of Rail Depreciation Costs[a] (Class I railroads)

History file	Depreciation[b] ($000)	Revenue ton-miles[c] (000,000)	Depreciation expense per revenue ton-mile (cents)
1967	765,768	719,498	.106
1968	775,356	744,023	.104
1969	788,857	767,841	.103
1970	812,684	764,809	.106
1971	823,507	739,743	.111
1972	840,324	776,746	.108
1973	826,304	851,809	.097
1974	832,506	853,887	.098
Forecast[d]			
1977	874,547	892,395	.098
1978	882,729	910,030	.097
1979	890,558	927,665	.096
1980	907,488	945,300	.096
1981	914,788	962,935	.095
1982	921,736	980,570	.094

[a] Includes depreciation and retirements.

[b] Statistics of Railroads of Class I, p. 12.

[c] Yearbook of Railroad Facts -- 1975, p. 29.

[d] Forecast based on straight-line regression analysis of revenue ton-miles and depreciation expense per revenue ton-mile.

Schedule F-II

Forecast of Motor Carrier Depreciation Costs[a] (Class I motor carriers)

History file	Depreciation ($000)	Revenue ton-miles (000,000)	Depreciation expense per revenue ton-mile (cents)
1967	200,300	62,635	.320
1968	216,311	70,075	.309
1969	238,540	77,005	.310
1970	243,613	71,914	.339
1971	250,815	77,185	.325
1972	268,669	84,864	.317
1973	313,370	94,547	.331
1974	N/A	N/A	N/A
Forecast[b]			
1977	365,963	108,273	.338
1978	383,367	112,755	.340
1979	402,123	117,237	.343
1980	419,931	121,719	.345
1981	437,917	126,201	.347
1982	457,387	130,682	.350

N/A -- not available

Source: General Freight Analysis, fourth quarter and twelve months cumulative, 1967-1973.

[a]Includes depreciation and amortization of carrier operating property.

[b]Forecast based on straight-line regression analysis of revenue ton-miles and depreciation expense per revenue ton-mile.

Schedule F-III

Forecast of Airline Depreciation Costs[a] (All-cargo carriers)

Domestic airlines

History file	Depreciation[b] ($000)	Revenue ton-miles[c] (000)	Depreciation expense per revenue ton-mile (cents)
1967	12,208	519,480	2.350
1968	19,878	494,181	4.022
1969	13,749	474,663	2.897
1970	5,039	301,453	1.672
1971	4,686	310,878	1.507
1972	3,970	378,718	1.048
1973	4,612	534,072[d]	.864
1974	6,178	533,176[d]	1.159
Forecast[e]			
1977	8,976	588,572	1.525
1978	9,437	618,808	1.525
1979	9,898	649,044	1.525
1980	10,359	679,280	1.525
1981	10,820	709,516	1.525
1982	11,281	739,752	1.525

International airlines

History file	Depreciation[b] ($000)	Revenue ton-miles[c] (000)	Depreciation expense per revenue ton-mile (cents)
1967	7,565	588,545	1.285
1968	9,288	674,127	1.378
1969	14,598	1,093,261	1.355
1970	13,747	1,122,874	1.224
1971	14,537	1,263,775	1.150
1972	13,222	1,332,555	.992
1973	11,451	1,138,973[d]	1.005
1974	15,951	1,112,518[d]	1.434
Forecast[e]			
1977	18,708	1,568,180	1.193
1978	19,681	1,649,737	1.193
1979	20,654	1,731,294	1.193
1980	21,627	1,812,851	1.193
1981	22,600	1,894,408	1.193
1982	23,573	1,975,965	1.193

[a] Includes depreciation and amortization expense.

[b] Source: For 1967 and 1968 data -- individual all-cargo reports filed with the Civil Aeronautics Board on CAB Form 41. For 1969 through 1974 data -- CAB matrix of airline cost elements.

[c] Handbook of Airline Statistics -- 1973, Part II, Table 4, p. 12.

[d] Air Carrier Traffic Statistics, December 1973 and December 1974, pp. 12 and 15.

[e] Forecast based on straight-line regression analysis of revenue ton-miles and average depreciation expense for 1969-1974. 1967 and 1968 were excluded because these data reflect expenses on a 42-state basis instead of a 50-state basis.

EXHIBIT G

FORECAST OF MISCELLANEOUS COSTS

This Exhibit, consisting of three (3) Schedules, projects the miscellaneous operating costs for Class I railroads and motor carriers and for all-cargo U.S. airlines operating domestic and international routes. The miscellaneous costs, as developed in the following Schedules, include all other operating costs not included or treated as labor, fuel, material and supplies, or depreciation. These costs include such items as insurance, loss and damage claims, operating licenses, miscellaneous taxes (other than federal and state income or property) and airport landing fees.

Schedule G-I -- Forecast of Rail Miscellaneous Costs. This Schedule contains the historical and projected miscellaneous costs for Class I railroads. It also contains historical and projected figures for revenue ton-miles and miscellaneous costs on a revenue per ton-mile basis. Miscellaneous costs for 1967 through 1974 were obtained by aggregating all operating costs not treated as labor, fuel, material and supplies, or depreciation.

Revenue ton-mile figures shown for 1967 through 1974 represent actual revenue ton-miles carried. Miscellaneous costs per revenue ton-mile for 1967 through 1974 were obtained by dividing total miscellaneous costs by the revenue ton-miles handled.

Miscellaneous cost projections for 1977 through 1982 were calculated by multiplying the projected costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Projected costs per revenue ton-mile were obtained by applying a linear regression analysis to the historical miscellaneous costs per revenue ton-mile. The results of this analysis were then used to calculate the projected costs for 1977 through 1982. Forecasted revenue ton-mile figures were also obtained by applying the linear regression method to the revenue ton-mile data for 1967 through 1974 and using the results of that analysis to obtain figures for 1977 through 1982.

Schedule G-II -- Forecast of Motor Carrier Miscellaneous Costs. This Schedule contains the historical and projected miscellaneous costs for Class I motor carriers, as well as historical and projected figures for revenue ton-miles and miscellaneous costs on a revenue ton-mile basis.

Miscellaneous costs for 1967 through 1973 were obtained by aggregating the operating costs not treated as labor, fuel, material and supplies, or depreciation. Miscellaneous cost figures for Class I motor carriers for 1974 were not available on a comparable basis with figures for 1967 through 1973.

The revenue ton-mile data for 1967 through 1973 represent actual revenue ton-miles carried. Figures for 1974 were not available on a comparable basis with figures for 1967 through 1973 and, therefore, are not included in the historical data base.

Historical costs per revenue ton-mile were obtained by dividing total miscellaneous costs by the revenue ton-miles carried.

Miscellaneous cost projections for 1977 through 1982 were calculated by multiplying the projected costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Costs per revenue ton-mile and revenue ton-mile figures for 1977 through 1982 were obtained by applying a linear regression analysis to the historical data bases developed for these respective items. The results of these analyses were then used to calculate the projected costs per revenue ton-mile and revenue ton-miles to be carried.

Schedule G-III -- Forecast of Airline Miscellaneous Costs. This Schedule contains the historical and projected miscellaneous cost data for all-cargo U.S. airlines operating domestic and international routes, as well as historical and projected figures for revenue ton-miles and miscellaneous costs on a revenue ton-mile basis.

Miscellaneous costs for 1967 through 1974 were obtained by aggregating all operating costs not treated as labor, fuel, material and supplies, or depreciation. The data presented for 1967 and 1968 were compiled from individual all-cargo carrier reports filed with the Civil Aeronautics Board (CAB). Miscellaneous costs for 1969 through 1974 were obtained from an internal CAB cost summary report. This report was started in 1969 and combines various airline operating costs by function and type of carrier.

Revenue ton-mile figures for 1967 through 1974 represent actual revenue ton-miles carried.

Miscellaneous costs per revenue ton-mile for 1967 through 1974 were calculated by dividing total miscellaneous costs by the revenue ton-miles carried.

Miscellaneous cost projections for 1977 through 1982 were calculated by multiplying the projected costs per revenue ton-mile by the projected revenue ton-miles to be carried.

Costs per revenue ton-mile and revenue ton-mile projections for 1977 through 1982 were obtained by applying a linear regression analysis to the 1969 through 1974 historical data bases developed for each item. The results of these analyses were then used to determine the projected costs per revenue ton-mile and revenue ton-miles to be carried.

Data for 1967 and 1968 were excluded from the regression analyses because these data were compiled on a different basis from the 1969 through 1974 data. Prior to 1969, all costs associated with operations from, to, and within Alaska and Hawaii were treated as international costs. Separate figures cannot be identified in the international cost for Alaska and Hawaii for the period 1967 and 1968. Therefore, the 1967-1968 data could not be adjusted on a comparable basis as data for 1969 through 1974.

Schedule G-I

Forecast of Rail Miscellaneous Costs[a] (Class I railroads)

History file	Miscellaneous expenses[b] ($000)	Revenue ton-miles[c] (000,000)	Miscellaneous expenses per revenue ton-mile (cents)
1967	956,133	719,498	.133
1968	1,052,850	744,023	.142
1969	1,176,036	767,841	.153
1970	1,293,110	764,809	.169
1971	1,405,450	739,743	.190
1972	1,445,976	776,746	.186
1973	1,623,793	851,809	.191
1974	1,789,447	853,887	.210
Forecast[d]			
1977	2,159,596	892,395	.242
1978	2,302,376	910,030	.253
1979	2,439,759	927,665	.263
1980	2,590,122	945,300	.274
1981	2,744,365	962,935	.285
1982	2,902,487	980,570	.296

[a] Includes expenses such as insurance, hire of equipment, loss and damage, and provisions for deferred taxes.

[b] Statistics of Railroads of Class I, p. 12.

[c] Yearbook of Railroad Facts -- 1975, p. 29.

[d] Forecast based on linear regression analyses of revenue ton-miles and miscellaneous expenses per revenue ton-mile.

Schedule G-II

Forecast of Motor Carrier Miscellaneous Costs[a] (Class I motor carrier)

History file	Miscellaneous expenses ($000)	Revenue ton-miles (000,000)	Miscellaneous expenses per revenue ton-mile (cents)
1967	759,343	62,635	1.212
1968	832,693	70,075	1.188
1969	963,224	77,005	1.251
1970	976,807	71,914	1.358
1971	1,069,214	77,185	1.385
1972	1,166,478	84,864	1.375
1973	1,311,024	94,547	1.387
1974	N/A	N/A	N/A
Forecast[b]			
1977	1,696,638	108,273	1.567
1978	1,807,463	112,755	1.603
1979	1,922,687	117,237	1.640
1980	2,041,228	121,719	1.677
1981	2,163,085	126,201	1.714
1982	2,288,242	130,682	1.751

N/A -- not available

Source: General Freight Analysis, fourth quarter and twelve months cumulative, 1967-1973.

[a]Includes expenses such as insurance, cargo loss and damage and operating taxes and licenses.

[b]Forecast based on linear regression analyses of revenue ton-miles and miscellaneous expenses per revenue ton-mile.

Schedule G-III

Forecast of Airline Miscellaneous Costs[a]
(All-cargo carriers)

Domestic airlines

History file	Miscellaneous expenses[b] ($000)	Revenue ton-miles[c] (000)	Miscellaneous expenses per revenue ton-mile (cents)
1967	58,263	519,480	11.216
1968	13,149	494,181	2.661
1969	22,682	474,663	4.779
1970	18,019	301,453	5.977
1971	16,984	310,878	5.463
1972	19,344	378,718	5.108
1973	24,683	534,072[d]	4.622
1974	29,395	533,176[d]	5.513
Forecast[e]			
1977	31,077	588,572	5.280
1978	32,685	618,808	5.282
1979	34,295	649,044	5.284
1980	35,900	679,280	5.285
1981	37,512	709,516	5.287
1982	39,125	739,752	5.289

International airlines

History file	Miscellaneous expenses[b] ($000)	Revenue ton-miles[c] (000)	Miscellaneous expenses per revenue ton-mile (cents)
1967	13,922	588,545	2.365
1968	20,045	674,127	2.973
1969	53,874	1,093,261	4.928
1970	57,339	1,122,874	5.106
1971	56,112	1,263,775	4.440
1972	66,924	1,332,555	5.022
1973	54,929	1,138,973[d]	4.823
1974	63,136	1,112,518[d]	5.675
Forecast[e]			
1977	86,956	1,568,180	5.545
1978	93,111	1,649,737	5.644
1979	99,428	1,731,294	5.743
1980	105,907	1,812,851	5.842
1981	112,547	1,894,408	5.941
1982	119,348	1,975,965	6.040

[a] Includes expenses such as insurance, loss and damage, and airport handling fees.

[b] Source: For 1967 and 1968 data -- individual all-cargo reports filed with the Civil Aeronautics Board on CAB Form 41. For 1969 through 1974 data -- CAB matrix of airline cost elements.

[c] Handbook of Airline Statistics -- 1973, Part II, Table 4, p. 12.

[d] Air Carrier Traffic Statistics, December 1973 and December 1974, pp. 12 and 15.

[e] Forecast based on linear regression analyses of revenue ton-miles and miscellaneous expenses per revenue ton-mile.

EXHIBIT H

COMPARISON OF DS/SD FORECASTS WITH OTHER SOURCES

This Exhibit, consisting of four (4) Schedules, compares the forecast results of several DS/SD projections with similar projections made by various government sources including the U.S. Bureau of Labor Statistics, the U.S. Department of Commerce, the U.S. Department of Transportation, and the U.S. Water Resources Council. The projections made by these sources relate primarily to forecasts of revenue ton-miles, number of employees, and average employee earnings.

The forecasting methods or techniques used to project the results of other sources were not identifiable by DS/SD. Consequently, the methods and results obtained by DS/SD were totally independent from the government projections reflected in the following comparisons.

Projections by government or other independent sources for all factors covered in the DS/SD forecast were not available; therefore, no similar comparisons could be made for these factors.

The following Schedules deal with projections for Class I railroads only. Similar comparisons for Class I motor carriers and all-cargo airlines were made; however, the results of these comparisons were inconclusive because the government projections generally included a broader class of carriers than DS/SD. For example, available projections for the motor carrier industry included Class I, II and III motor carriers, as well as public warehousing data. Similarly, airline projections generally included data pertaining to all-cargo and combination passenger/cargo statistics. Figures were not available to adjust either the DS/SD data base or the government data to reflect a comparable basis for comparison purposes.

While the comparisons made in the following Schedules do not cover all the basic factors projected by DS/SD, they do cover two (2) significant elements -- labor and revenue ton-miles.

Given the independent nature of DS/SD's forecasting methods and techniques, the results of our projections compare very favorably with those made by the government sources referenced.

Schedule H-I -- Comparison of Railroad Employees. This Schedule contains the DS/SD forecast of railroad employment for 1976 through 1985 as well as a comparison of DS/SD projections with those made by the U.S. Bureau of Labor Statistics (BLS) and the U.S. Water Resources Council (WRC). Specific BLS and WRC figures for comparison purposes were available only for the years 1980 and 1985.

The DS/SD projections were developed and brought forward from Exhibit C, Schedule C-I -- Forecast of Rail Labor Costs. The forecasts contained in this Schedule are based on projections for employment by Class I railroads only.

The figures projected by BLS reflect employment forecasts for Class I railroads, Class I and II railroads combined, and for the railroads as an industry (Class I, II, and III railroads combined). These are reflected by the figures shown under BLS columns 1, 2 and 3, respectively.

The figures for WRC are predicated on employment projections for all railroads as an industry.

The BLS column projections are comparable to DS/SD projections since both forecasts reflect employment figures based on Class I railroad employment. DS/SD comparisons with BLS columns 2 and 3 and WRC projections serve only to establish the overall reasonableness of DS/SD projections with other projections made on an industrywide basis.

Schedule H-II -- Comparison of Railroad Employee Earnings. This Schedule contains a DS/SD comparison of employee earnings for Class I railroads with projections made by the U.S. Water Resources Council (WRC) and the U.S. Department of Commerce (DOC).

The DS/SD projections were developed and brought forward from Exhibit C, Schedule C-I -- Forecast of Rail Labor Costs. The forecasts contained in this Schedule are based on projections for the average annual employee earnings for Class I railroad employees.

The figures projected for WRC and DOC were not specifically expressed as average employee earnings. They were developed by DS/SD based on WRC and DOC projections of total employee earnings and total employment. WRC and DOC average employee earnings were calculated by dividing total projected employee earnings by total projected employment. Before this calculation could be made, however, it was necessary for DS/SD to convert the WRC and DOC earning figures from constant 1967 dollars to current dollars for 1980 and 1985. This was accomplished through the use of the Gross National Product (GNP) Implicit Price Deflator developed in Schedule H-IV. A more detailed explanation of how the GNP Implicit Price Deflator is used to convert constant dollars to current dollars and vice versa is discussed below in Schedule H-IV -- Gross National Product Index.

Schedule H-III -- Comparison of Railroad Revenue Ton-Miles. This Schedule contains a comparison of DS/SD forecast of Class I railroads with revenue ton-mile projections made by the U.S. Department of Transportation (DOT).

The DS/SD projections were developed and brought forward from Exhibit C, Schedule C-I -- Forecast of Rail Labor Costs. The forecasts contained in this Schedule are based on projections of revenue ton-miles for Class I railroads.

The DOT figures in column 1 reflect unadjusted revenue ton-mile projections. Column 2 DOT projections have been adjusted to reflect the impact of future crude oil prices on railroad revenue ton-miles to be carried.

A comparison of DS/SD revenue ton-mile forecasts with those made by the U.S. Department of Transportation indicates that DS/SD projections are reasonable and in line with DOT projections.

Schedule H-IV -- Gross National Product Index. This Schedule was developed by DS/SD so that all dollar amounts expressed in this Report, or in other source documents referenced in this Report, could be converted easily from current dollars to constant 1958, 1967 and 1971 dollars or vice versa. The years 1958, 1967, and 1971 were chosen because they are the years most commonly referred to by the government for GNP comparison purposes.

The GNP Index developed in this Schedule represents the actual or projected yearly percentage increase in the rate of inflation that is occurring from one year to the next. This figure is calculated by dividing each subsequent GNP constant dollar amount by the previous GNP constant dollar amount, i.e., in terms of 1958 dollars, the inflation rate from 1958 to 1959 was equal to an average annual increase of 6.4 percent ($475.9 billion ÷ $447.3 billion).

The Implicit Price Deflator developed in this Schedule is used either to convert constant dollars into current dollars or vice versa. It is calculated by dividing the constant dollar figures by the current dollar figures. The resulting percentages obtained from this calculation are then expressed as the Implicit Price Deflator. The Implicit Price Deflator is used to convert current dollars into constant dollars by multiplying the current dollar figure to be converted by the figure shown under the appropriate price deflator column. To convert constant dollars into current dollars, the constant dollar figure is divided by the figure shown in the price deflator column. To further illustrate the use of the GNP Implicit Price Deflator, the following example uses the price deflator to convert 1967 constant dollars into current dollars and vice versa:

> In 1973 the GNP, in terms of constant 1967 dollars, was $986.7 billion. The Implicit Price Deflator associated with the year 1973, in terms of constant 1967 dollars is .76199, hence, to convert $986.7 billion into current dollars, this figure is divided by .76199 or is equal to current dollars of $1,294.9 billion (986.7 ÷ .76199 = 1294.9). To reverse this process or to convert $1,294.9 billion into constant 1967 dollars, this figure is multiplied by .76199 or is equal to constant 1967 dollars of $986.7 billion (1294.9 x .76199 = 986.7).

GNP figures for current and constant 1958 dollars from 1958 through 1974 were obtained from published U.S. Bureau of Labor Statistics (BLS).

Projected GNP current and constant 1958 dollars were obtained from the Citibank of New York City. Constant dollar figures for 1967 and 1971 were calculated by DS/SD using the data obtained from BLS and Citibank. DS/SD also calculated all of the GNP indexes and Implicit Price Deflators

Schedule H-I

Comparison of Railroad Employees

Year	Forecast: number of employees				
	DS/SD[a]	BLS[b]			OBERS[c]
		(1)	(2)	(3)	
1976	484,600				
1977	471,200				
1978	457,800				
1979	444,400				
1980	431,000	432,000	448,000	455,000	478,000
1981	417,600				
1982	404,200				
1983	390,800				
1984	377,400				
1985	364,000	346,000	359,000	364,000	415,000

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[a]DS/SD forecast based on linear regression analysis using history data from 1967 through 1974 for Class I railroads.

[b]The U.S. Economy in 1985, Bulletin 1809, U.S. Department of Labor, Bureau of Labor Statistics (BLS); 1974:

(1) Employement for Class I railroads, Table C-4, p. 60.

(2) Employment for Class I and Class II railroads, Table C-4, p. 60.

(3) Employement for the Railroad Industry, Table C-3, p. 53.

[c]1972 OBERS Projections, Employment in Railroad Transportation Industry, Table 1, p. 38.

Schedule H-II

Comparison of Railroad Employee Earnings

Year	Forecast: employee wages		
	DS/SD[a]	OBERS[b]	Department of Commerce[c]
1976	18,129		
1977	19,230		
1978	20,332		
1979	21,433		
1980	22,535	22,649[d]	22,649[d]
1981	23,636		
1982	24,738		
1983	25,840		
1984	26,941		
1985	28,043	30,361[e]	30,361[e]

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[a]DS/SD forecast based on straight-line regression analysis using history data from 1967 through 1974 for Class I railroads.

[b]1972 OBERS Projections, Table 1, p. 38.

[c]Area Economic Projections, 1990, Table 1, p. 17.

[d]Employee earnings for 1980 were calcualted as follows:

Total employee earnings (constant 1967 dollars)	$5,612,000,000
Current dollars[1]	$10,826,000,000
Number of employees	478,000
Average wages per employee (current dollars)	$22,649

Employee earnings for 1985 were calculated as follows:

Total employee earnings (constant 1967 dollars)	$5,502,900,000
Current dollars	$12,600,000,000
Number of employees	415,000
Average wages per employees (current dollars)	$30,361

[1]Constant 1967 dollars converted to current dollars through the use of GNP Implicit Price Deflator in Schedule H-IV.

Schedule H-III

Comparison of Railroad Revenue Ton-Miles

Year	Forecast: Revenue ton-miles (millions)		
		DOT	
	DS/SD[a]	(1)[b]	(2)[c]
1976	874,760		
1977	892,395		
1978	910,030		
1979	927,665		
1980	945,300	919,000	960,000
1981	962,935		
1982	980,570		
1983	998,205		
1984	1,015,840		
1985	1,033,475	1,030,000	1,100,000[d]

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[a] DS/SD forecast based on linear regression analysis using history data from 1967 through 1974 for Class I railroads.

[b] 1974 National Transportation Report, U.S. Department of Transportation (DOT), Table II-7, p. II-19.

[c] Ibid, Table XI, p. XI-11 (projection based on crude oil price of $11.00 per barrel).

[d] Extrapolated from Table XI.

Schedule H-IV

Gross National Product Index
(Billions of dollars)

Year	Current dollars[a]	1958 dollars[a] Constant dollars	1958 dollars[a] Implicit price deflator	1967 dollars[b] Constant dollars	1967 dollars[b] Implicit price deflator	1971 dollars[b] Constant dollars	1971 dollars[b] Implicit price deflator
1958	447.3	447.3	100.0	525.9	117.6	632.3	141.4
1959	483.7	475.9	.98387	559.6	115.7	672.7	139.1
1960	503.7	487.7	.96824	573.4	113.8	689.4	136.9
1961	520.1	497.2	.95597	587.6	112.4	702.8	135.1
1962	560.3	529.8	.94556	622.9	111.2	748.9	133.7
1963	590.5	551.0	.93311	647.9	109.7	778.8	131.9
1964	632.4	581.1	.91888	683.3	108.0	821.4	129.9
1965	684.9	617.8	.90203	726.4	106.1	873.3	127.5
1966	749.9	658.1	.87758	773.8	103.2	930.2	124.0
1967	793.9	675.2	.85048	793.9	100.0	954.4	120.2
1968	864.2	706.6	.81763	830.8	.96135	998.8	115.6
1969	930.3	725.6	.77996	853.2	.91712	1,025.6	110.2
1970	977.1	722.5	.73943	849.5	.86941	1,021.3	104.5
1971	1,054.9	746.3	.70746	877.5	.83183	1,054.9	100.0
1972	1,158.0	792.5	.68437	934.4	.80691	1,120.2	.96736
1973	1,294.9	839.2	.64808	986.7	.76199	1,186.2	.91606
1974	1,397.4	821.2	.58766	966.1	.69136	1,160.8	.83069
1975	1,471.2	794.7	.54017	934.4	.63513	1,125.3	.76353
1976	1,601.6	828.2	.51711	973.8	.60802	1,170.7	.73096
1977	1,759.2	879.1	.49972	1,033.6	.58754	1,242.6	.70634
1978	1,944.2	937.8	.48236	1,102.7	.56717	1,325.6	.68182
1979	2,185.6	1,004.0	.45937	1,180.5	.54013	1,419.2	.64934
1980	2,413.5	1,064.0	.44085	1,251.1	.51838	1,504.0	.62316
1981	2,598.0	1,106.6	.42594	1,301.1	.50081	1,564.2	.62208
1982	2,783.1	1,145.3	.41152	1,346.6	.48385	1,618.9	.58169
1983	2,966.2	1,179.4	.39761	1,386.7	.46750	1,667.1	.56203
1984	3,159.3	1,214.2	.38433	1,427.7	.45190	1,716.3	.54325
1985	3,365.0	1,250.0	.37147	1,469.7	.43676	1,766.9	.52508

[a]Source: Handbook of Labor Statistics -- 1975, Table 179, pps. 444-447, (for period 1958-1974). Citibank, Economics Department, New York, New York, (for period 1975-1985).

[b]Calculated using source data.